# SCIENTIFIC AMERICAN

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## THE DRIVEN WELL SYSTEM OF THE BROOKLYN WATER WORKS.

The method of obtaining an additional supply of water for the city of Brooklyn, N. Y., by means of driven wells, has attracted widespread attention because of the originality and boldness of the plans and the perfect success attained; and not only is the same system applicable in the case of other large cities similarly in need of more water, but it is particularly adapted for small towns near which there is no stream of sufficient size to furnish all the water required.

A town unprovided with water works can obtain its supply from driven wells, and an immense aggregate quantity of water can thus be obtained in thickly peopled districts from a comparatively small ground area. But the position of these wells in relation to each other would of course vary with the needs of the owners, and a systematic distribution would be impossible. But if we think of these wells as being arranged in regular order, at certain distances apart along a line extending at right angles to the flow of the underground streams, each one being connected with a large collecting pipe leading to a powerful pump, we shall have an accurate conception of the Andrews system as now in operation in Brooklyn. In an early issue of the SCIENTIFIC AMERICAN we shall describe this system more in detail.

At the Clear Stream pumping station there are 152 driven wells, 2 inches in diameter, arranged in pairs 18 feet apart. This makes two lines of wells, parallel with and between which is the collecting main, 16 inches in diameter. The top of each well tube is connected with the main by a 3 inch pipe; and in each connecting pipe is a valve by which any of the wells can be shut off. Located at the center of the collecting main, which is 1,368 feet long, is the engine house, the interior of which is shown below.

It is apparent that, in the establishment of any such system of water supply, it is of the highest importance that all the material which goes to make up the working plant shall be of the most efficient and thoroughly reliable character, and, with this end in view, the officers of the Brooklyn government contracted for the working of the Andrews system with the Knowles pumping engines. A good view of the plant in one of the stations is given on this page. There are two compound, crank and fly-wheel, duplex condensing pumping engines. The engines were put in under a guarantee to deliver 10,000,000 gallons each 24 hours, but their actual pumping capacity is much in excess of this, since they have delivered 14,000,000 gallons and over during many successive days. The economical duty of these engines is between 80,000,000 and 90,000,000 foot pounds per 100 pounds coal under ordinary working conditions.

The pumping engines are provided with automatic cut-off valve gear of the most approved type, using steam pressure of 90 pounds per square inch. The steam cylinders are arranged on the cross compound plan—that is to say, in each engine, the high pressure cylinder works one water pump and the low pressure cylinder works the other. The pump cylinders are directly connected with the back ends of the steam cylinders. The steam, after having been used in the high pressure cylinder, is carried over to the low pressure cylinder, where it is used a second time before going to the condenser. An intermediate receiver is placed on the pipe between the high and the low pressure cylinder.

The water cylinders have inside packed pistons. The valve area is exceptionally large, so as to admit of a very great quantity of water being pumped with minimum amount of friction. The suction valves are placed below the pump barrel and the discharge valves above, thereby giving the most direct course to the water as it passes through the pumps from the wells to the aqueduct. The suction and discharge pipes for each pumping engine are 20 inches diameter, the suction pipe, of course, leading to the collecting main of the wells, and the discharge pipe extending to the conduit running to the city.

Owing to the admirable design of these engines, they are able to lift water from the greatest possible depth, a vacuum of 26 to 27 inches being readily obtained.

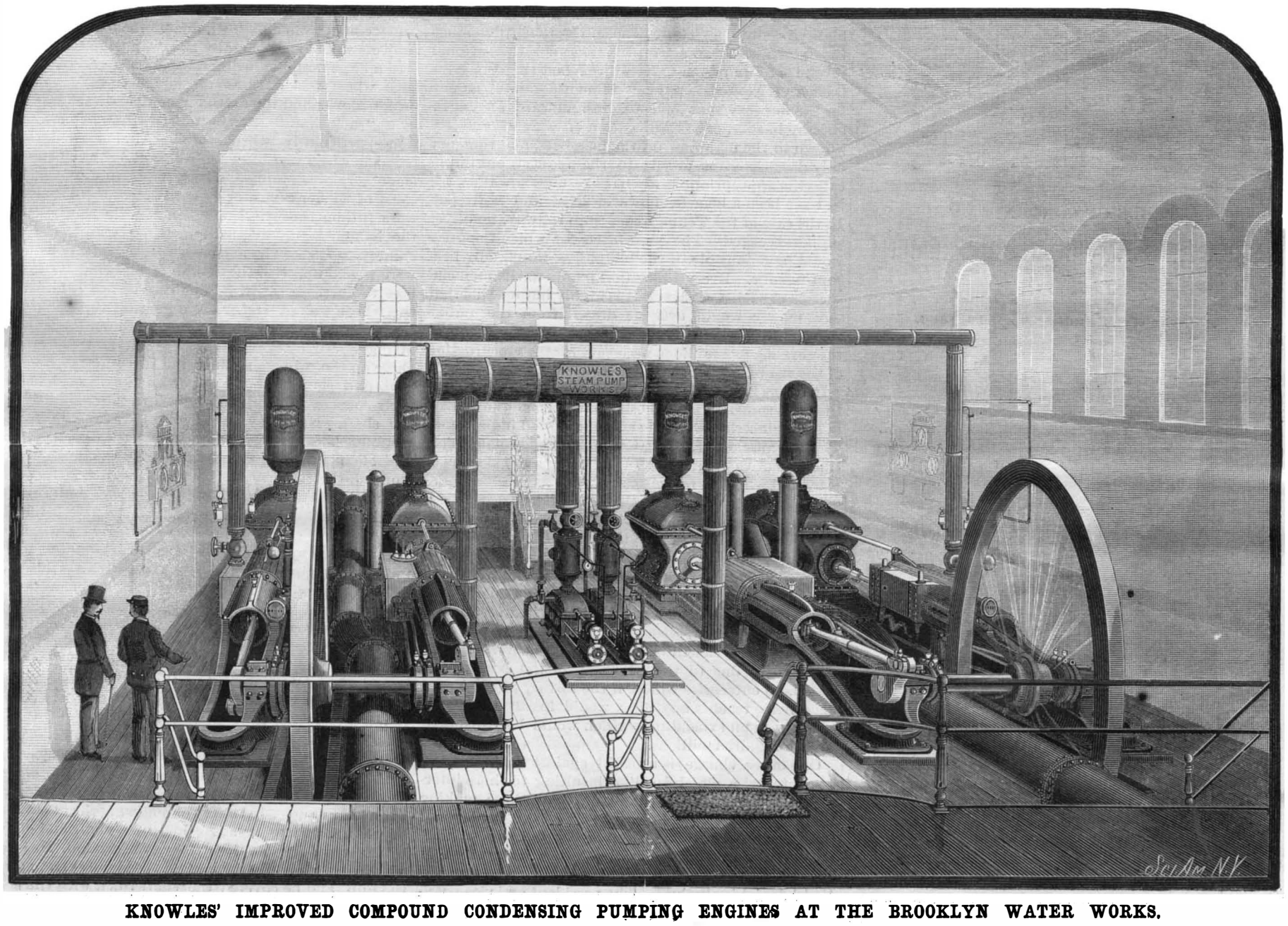
The air pumps for the condensers are of novel construction. They are arranged on the independent system, and are provided with double pump cylinders.

The leg pipe of the condenser goes into one pump, and the air pipe from the condenser goes into the other pump, thereby discharging all the water into one pump and the air into the other; sufficient water is taken in the air cylinder to supply the hot well, by that means securing a higher temperature of water to feed the boilers than would be obtained by the usual design of air pump.

As shown by the engraving, the exhaust steam from each engine passes through an overhead heater, and enters the condensers and air pump shown in the center of the room. The advantage of the independent air pump is that a vacuum can be readily secured for the engines before they are started.

The heater, steam pipes, and steam cylinders are handsomely lagged with black walnut, bound with polished brass bands. The valve seats, piston rods, and water piston are made of gun metal composition, thereby insuring great durability. The cylinders are also lined with composition.

This is the fourth compound pumping outfit supplied for the city of Brooklyn by the Knowles Steam Pump Works, making in all eight compound pumping engines, with their boilers and connections complete. The water works authorities are so well pleased with the performance of these engines that they have specified the same class of engine for a proposed further extension of the water supply.




KNOWLES' IMPROVED COMPOUND CONDENSING PUMPING ENGINES AT THE BROOKLYN WATER WORKS.

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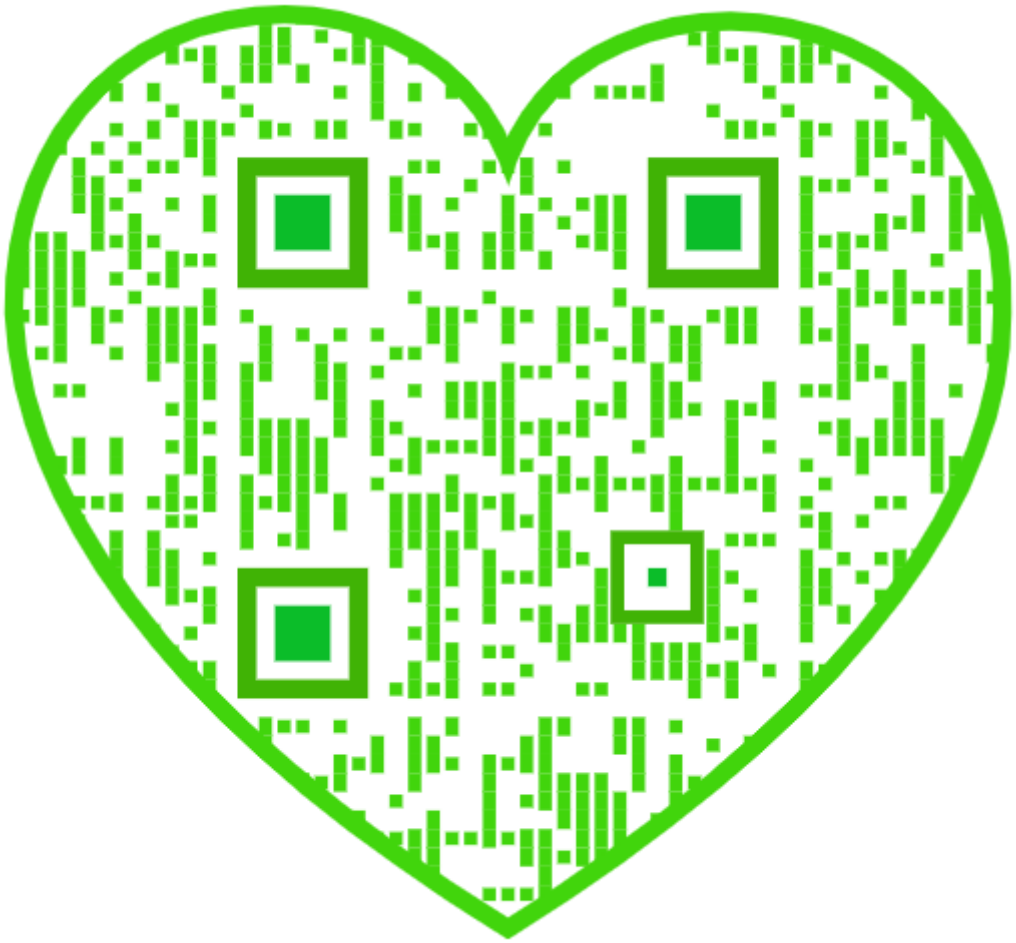

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### THE TEHUANTEPEC SHIP RAILWAY.

Seldom has any public enterprise received such gross misrepresentation at the hands of the press as has been the portion of Captain Eads' proposed ship railway across the Isthmus of Tehuantepec. Every effort to make what is, in itself, an honorable proposition seem odious appears to have been made. The enterprise is one which is open to thorough inspection, and therefore an ignorance of the subject is the more unpardonable in those who assume the position of critics. In many of the statements made there is such an evident absence of truthfulness that one is forced to believe the error is not unintentional. It is asserted in more than one quarter that no survey of the route has ever been made by the present company, when, in truth, the greater part of the $350,000 already expended has been for a complete hydrographical and topographical survey of the isthmus from ocean to ocean; that the United States is appealed to as a last resort, when, in point of fact, it is the first government approached; that the ship railway is pronounced impracticable by the acknowledged experts of the world, whereas the very opposite is the case. The Canadian Government has just subsidized a ship railway to be built from the Bay of Fundy to the Gulf of St. Lawrence, under the direction of Sir John Fowler, one of the ablest engineers of our times. It is further asserted by Captain Eads' opponents that the capitalists of Europe and America have refused to have anything to do with the project, when they have had no such opportunity, for their aid has not yet been solicited. But of all these misstatements, probably the most flagrant is that the United States is asked to give $37,500,000 to aid in building the ship railway. By no misinterpretation of the English language can such a conclusion be reached. The bill now before Congress provides distinctly that the government shall not pay a single dollar until the railway is completed, until it has passed a satisfactory official examination, and has successfully carried a vessel of specified tonnage from ocean to ocean.

These conditions could not be stated more plainly nor could a more severe test of the company's good faith be demanded. When this great work has been accomplished, the Government is only asked to guarantee that, for a period of fifteen years, two-thirds of the net annual revenue of the railway shall be $2,500,000. By no reasonable possibility could the Government be liable for the entire guarantee. As the net revenue is taken at one-half the gross receipts, the total liability of the Government, at the most unfavorable estimate, would not exceed $7,500,000, and that in equal payments over a period of fifteen years. But even if the entire sum guaranteed were to be drawn from the public treasury, the country, it seems to us, would find the investment highly profitable. Those who so vigorously denounce the enterprise as an attempted raid upon the national revenues do not seem to recall the fact that Congress is each year asked to pay out immense sums of money for the improvement of some insignificant stream or obscure harbor, even the location of which is scarcely known to the majority of the members, and that not only does Congress accede to the request, but duplicates the appropriations when the results show the work to have been a benefit, however local and restricted. In the case of the Tehuantepec ship railway, no direct support is asked. The guarantee for which Congress would be reponsible, if the bill passes, would only be a contingency. Every indication points to the financial success of such a road, and it is highly improbable that any money would ever be drawn from the public treasury. But the guarantee is desirable, in order that the seventy-five millions necessary for the construction of the road may be raised on the most favorable terms.

It seems incredible that, under these circumstances, the Government should hesitate to become the patron of an engineering work of such undoubted importance. The advantages of having an interoceanic communication under American control; of being able, in times of war, to have the squadrons of the Atlantic and Pacific co-operate without doubling Cape Horn; of enjoying, in times of peace, the reduced tolls accorded to American shipping, and all the impetus to that industry which such a discrimination means—these seem to us of sufficient value to warrant the assumption of a much graver responsibility than Captain Eads has demanded, and to make what he has asked seem absolutely insignificant.

Much of this violent opposition to the enterprise appears to be due to the adherents of the Nicaraguan Canal, an enterprise which, if the history of the Panama scheme teaches anything, would involve the Government in an expenditure which would be calculated by the hundred millions.

One other charge is brought against the Tehuantepec enterprise, which is alike insulting to those interested in its success and discreditable to those making the assertion. The statement has been made, and is reiterated in a large portion of the daily press, that an extensive and influential lobby is maintained at Washington in the interest of the enterprise. Captain Eads' denial is absolute. The president and vice-president of the company and its counselor are the only persons who have authority to speak in its interest. We do not believe that these gentlemen have need of such methods, were they willing to employ them, nor do we believe that the committee who have charge of the bill are open to the persuasiveness of such arguments.

### LICENSES FOR SMALL STEAMBOATS.

The yachting season is now pretty well upon us, and the number of inquiries which we have already received in regard to the laws regulating steam yachts indicates that it will be one of considerable activity. It may therefore be of interest to our readers to know what requirements must be fulfilled before their pleasure craft may be enjoyed in peace and quietness.

The United States law says that all steam launches of five tons burden or less must pay a license of $5, and for master, pilot, and engineer 50 cents each. The hulls and boilers must be inspected by the United States local inspectors, and a permit from the nearest custom house must also be written upon the inspection certificate.

In regard to the equipment of yachts of this size, the law provides that, where passengers are carried, the lifeboat may be dispensed with, if the vessel is provided with metallic air chambers placed under the seats or in the ends, of sufficient buoyancy to float both vessel and machinery. One life preserver must be provided for each person whom the inspection certificate allows them to carry. For each fifteen passengers or less two fire buckets and one ax are required.

One of our subscribers in Camden, N. J., had rather an unpleasant experience from his want of knowledge of these requirements. He had an interest in a 25-foot launch of 1¾ tons custom house measurement, which had been built under the impression that no license was required. The vessel had only been out a few times when it was seized by the custom house officers for not complying with the law. After a great deal of trouble and some expense, she was finally cleared, and was licensed, inspected, and equipped to start on her career afresh. A license of $5 was paid, but a few days later a notice was received that it should have been $25, and that $20 was still due. As a refusal to comply with this demand led to a threat of second seizure, the amount was paid under protest. Five dollars was afterward recovered, but where the difference went still remains a mystery to the owners.

### SHOP COMMON SENSE.

Sometimes even shop lore, and engineering skill, and mechanical experience are at fault, and there is no resort in an emergency but plain common sense, untrammeled by precedent. And it is not unfrequently the case that the successful suggestion in an emergency comes from a man whose opinions on mechanical subjects would not generally receive much attention.

In a large manufacturing establishment a heavy balance wheel was used as an equalizer between the prime mover and the driven machinery, and was run by a "jack shaft." It was noticed that when in motion—particularly when stopping and starting—the balance wheel was loose on its shaft. But when the machinery was stopped, all attempts to discover the cause of the looseness, or even to detect the looseness, were futile; the wheel was firm on the shaft. Still, the looseness was an apparent fact as soon as the machinery started. The attempts to discover the trouble were given up, with the design of allowing the looseness to increase until it would manifest itself when the wheel was at rest. An observant operative in the mill asked leave to try, and he found the trouble at once. He blocked the jack shaft, and put a purchase on the wheel against the direction of its motion, and showed that the key and key seat had lost their corners, allowing the wheel to move slightly on the shaft. New key seats and keys rectified the trouble. The man had thought out the difficulty in a sensible manner. He imagined that when the shaft stopped, the impetus of the wheel carried it forward enough to squeeze or lock the loose key, and that a purchase backward would reveal the trouble, which it did.

Some years ago an establishment was building some propeller engines for the Government. As this was before the adoption of the plan of raising the propeller when the vessel was to be driven by sail alone, the engines and propeller were disconnected by clutches worked by compound levers. These clutches were large and heavy, the flanges being about six feet diameter. They were shrunk on the shaft. In shrinking one of the glands on, it stuck before coming to place. It was a bad job; the clutches were costly; they had been bored and turned; the jaws were faced with steel; they represented the work of weeks; to smash the stuck gland would be an expensive job. One of the shop hands, who had no particularly high standing as a workman, suggested a way of removing the gland and he was allowed to try. He hung the shaft and gland by the steam derrick, the gland on the ground. He built a high dam of clay on the back of the gland surrounding the hub, and he covered the shaft thick with the clay for some distance above the hub. Large quantities of

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red hot lead were then poured into the dam surrounding the hub; the hub was expanded, and on raising the shaft the gland dropped off.

An annoying thump in a stationary engine bothered the engineer for days. As time allowed he inspected and repaired, removing and replacing the brasses, opening the cylinder and examining the rings, inspecting the crosshead, and testing every moving part. In vain. But he was not a man to give it up. He sat thinking in the doorway of his engine room one day, when, in the sunlight that gleamed over the crosshead and slides, he saw a spurt of fine mist rise from the brasses next the crosshead, as the piston started on its outward stroke. The shooting mist and the faint thump were synchronous; the logic of cause and effect gave him the clew to the matter. After shutting down at night he removed the brasses and found a very slight indentation on the gib, hardly perceptible. This was filed out, a skein of sheet brass put in, and the thump was gone.

### A System of Awards for Workmen.

By his observation and every day experience in the workshop, an intelligent workman will be constantly discovering better ways of doing the ordinary work about his bench or lathe than he was taught to do, or his fellow workmen continue in doing.

It may not reach the dignity of a patentable improvement that he has conceived, but it is a wrinkle which increases the workman's value to his employer and at the same time renders his labor less irksome to himself.

It is not the most original inventions that always pay the best, but it is the little things, the aggregation of useful ideas, like those suggested by the different workmen, that increases the capacity of a machine shop, and gives it a reputation for good work. And it is but right that the workman who suggests these improvements which are beneficial to the manufacturer should be rewarded by his employer; and if it was made the practice in large establishments to thus recognize the merit of the most painstaking and ingenious workmen, we believe the employer would derive much greater benefit than the money outlay; besides, he would have the gratification every one feels in according a helping hand to a worthy person.

To encourage their workmen to be constantly on the watch for any possible improvements, a regular system of awards has been established in a number of English works, and, after five years' trial, has met with a success that has more than justified its adoption.

The ship building firm of Denny & Brothers, at Dumbarton, inaugurated such a system in the summer of 1880; and in recording their very gratifying experience, we do so in the hope that American firms will be prompted to undertake a similar enterprise.

The committee of independent judges who decide upon the awards have now issued their sixth annual report, and placed it in circulation among the workmen, to stimulate them to renewed effort. Originally, the awards varied from ten to fifty dollars, according to the worth of the improvements for which claims were lodged with the committee. After a year's trial, the Messrs. Denny authorized the committee to increase the award where they saw fit, or, if the workman preferred, offered, in addition to the award of fifty dollars, to take out a provisional patent at their own expense, in which case the firm reserved the right to use the improvement at its own works, but left the further disposition of the patent with the inventor. In 1883, the minimum and maximum awards were increased to fifteen and sixty dollars respectively. Still a little later, it was intimated that a premium of one hundred dollars would be paid to each workman when he had received as many as five awards. When he had received ten, this would be increased to one hundred and twenty-five dollars, and so on, twenty-five dollars extra being added to the original premium with each five awards.

The report for the years 1880 to 1884 inclusive shows that about $2,600 was disbursed in this manner, $1,400 being paid out during the latter year. Of this sum, $1,000 went in payment for the regular awards, and $400 as four premiums. Up to this time, four inventions had gained the maximum award. One of these, an improved method of laying the Decauville Railway across the main line, gained an additional reward of fifty dollars from the patentee of the railway. One-half of the rewards given were gained by workmen in the joiners' and carpenters' department. An arrangement was also made with another firm which had adopted a similar system of awards, by which any improvement introduced in either works could be utilized in the other by the payment of a duplicate award to the inventor. During the past year, the scheme has been in vigorous operation, and in spite of the large reduction in the number of men employed, the total of the awards has been greater than before. The minimum award has been reduced again to ten dollars, so as to permit a larger number to be given, but the maximum award has been increased to seventy-five dollars. The system of premiums has also been rearranged on a fairer basis. When a workman has received five awards, his premium is made equal to their total value. The twenty-five dollars, however, is added successively as before.

The decisions of the committee have proved remarkably just, for of the improvements accepted nearly every one has turned out of practical value. They cover a wide range of subjects, from mechanisms of general application to the detailed arrangements on shipboard.

In a number of establishments in this country, the workmen are financially encouraged to make improvements in the machines and processes in use, but in none of them, we believe, has the scheme been so thoroughly systematized as among the English workers. The marked success which has been experienced by the Messrs. Denny commends their system to imitation on this side of the water.

### The Education of Gas Managers.

In the course of an address before the S. W. District Association, Mr. G. Garnett said:

Higher education among artisans, foremen, and managers was now regarded as a necessity in all our great industries, and it seemed that the time had come when, in gas manufacture, as in other branches of engineering and applied chemistry, a scientific training must become a factor in the product; and we must look to the combination of science with practical experience for the chief improvements which are to be made in the future. The questions then arise, What course of study is to be pursued? And how is the necessary training to be obtained? As part of the general education of the gas engineer, we may regard French, German, and geology, including the inspection of a few typical mines and coke ovens. The more systematic training should comprise mathematics, elementary mechanics, hydrostatics, hydraulics, graphic statics, including the determination of stresses in framed structures, such as roofs, principals, girders, etc., shearing stress and bending moment in continuously loaded girders, strength of materials, including practical work with testing machine, transmission of power by mechanical means, practical geometry, machine drawing, building construction, heat, light, electricity, and magnetism, including practical laboratory work; chemistry, including a systematic course of lectures and proceeding as far as coal and gas analysis, the elements of the metallurgy of iron and steel, [illegible] if use of engineer's tools, must be added the free run of a short course [illegible] and a course of instruction in gas manufacture and the chemistry of the coal tar products.

Twenty years ago it would have been impossible for a youth of average education to obtain such a course of instruction; but under the auspices of the City and Guilds of London Institute, evening classes are now being held in mechanical and electrical engineering, wood and metal tools, iron, steel, gas manufactures, and tar products, in most of our principal towns. And these classes, combined with the instruction afforded by the government science classes, afford no mean training to those unable to avail themselves of a more thorough and systematic course. But a higher class of technical and scientific education may be desirable for engineers and managers, and this is now being rapidly provided by the local university colleges in several large towns, especially in the Finsbury Technical College and the Central Institution of the City and Guilds of London Institute, at fees for the complete course ranging from £9 to £31 10s. per annum.

The course at the Finsbury College extends over two years, and includes mathematics, practical geometry, and machine drawing, theoretical and applied mechanics, with laboratory practice; light, heat, and electricity, including practical work in the physical laboratory; chemistry, French, German, and the use of tools. The engineering workshops are provided with a gas engine and steam engine, specially fitted with appliances for experimental testing, shafting, dynamos, and other appliances used in the electric lighting of the college buildings.

The regular course of instruction averages 36 hours per week. Last session there were special courses of lectures on "Gas" and "Gas Engines," and during the present session on "Coal Tar Products." This course may be regarded as sufficient for all except those who wish to fit themselves for the most responsible positions, in which case it should be supplemented by one or two years of study at the Central Institution, South Kensington, or by a complete course in the engineering department of the Institution, extending over three years. The student will not only be provided with the most complete appliances, but, what is more important, will be brought into constant intercourse with some of the most eminent teachers of the day.

In concluding, Mr. Garnett said that if it was not given to all to seek the lofty heights of science or fathom the depth of philosophy, there was much that all could do in grasping the facts of the natural sciences. Let every one get and give what he can, and encourage his brother. In the words of Judge Payne:

Do what you can, be what you are,
Shine like a glow worm, if you cannot be a star;
Work like a pulley, if you cannot as a crane,
Be a wheel greaser, if you cannot drive a train.
Be the pliant oar, if you cannot be the sailor,
Be the little needle, if you cannot be the tailor;
Be the cleaning broom, if you cannot be the sweeper,
Be the sharpened sickle, if you cannot be the reaper.

## DECISIONS RELATING TO PATENTS.

### Supreme Court of the United States.

PRESTON *v.* MANARD *et al.*

"This was a bill in equity for the infringement of letters patent granted Oct. 10, 1876, and reissued February 28, 1882, for an improved fountain hose carriage.

"The first claim in the original patent was as follows: '1. The hose reel, mounted upon a wheeled carriage, which is provided with a foot or brace, by means of which it may be sustained in an upright vertical position, whereby the device becomes capable of use both as a hose carriage and as a fountain standard, substantially as specified.'" A former suit under the original patent was dismissed for want of novelty. The specification in reissue patent is exactly like that in original, but with different claims, the only material one of which was in these words: "1. The combined hose carriage and fountain standard, consisting in the combination of the following elements, viz.: a wheeled carriage provided with a foot or brace by means of which it may be sustained in an upright vertical position, a nozzle-holding device, and a reel of large diameter to allow the water to flow through the hose when partially wound thereon, substantially as specified." "The hose reel, the standard, the brace, the nozzle holder, and their use in combination being all old, the description of the hose reel in the specification and claim as 'a reel of large diameter to allow the water to pass through the hose when partially wound thereon,' is not sufficient to sustain the patent." "The fact that water will flow through a hose wound on a reel, if the diameter of the reel is large enough and the curves or angles are not too abrupt, is a matter of common knowledge, which no one can appropriate to his own use to the exclusion of the public. In any view of the case, the specification describes nothing that the patentee is entitled to claim, but only what every one has a right to use without his assistance."

"To sustain this patent [illegible] public of the [illegible] way in which [illegible] accomplished."

Appeal from the Circuit Court of the United States for the Northern District of Illinois.

Mr. Justice Gray delivered the opinion of the court.

### U. S. Circuit Court.—Southern District of New York.

ARON *v.* THE MANHATTAN RAILWAY COMPANY.

GATE OPERATING DEVICE.

Wallace, J.:

A device for opening and closing the gates of railway cars, consisting of a link connecting a sliding rod with the gate, and a rod sliding in or on bearings secured to the guard rail, and having a handle located within convenient reach of the attendant, does not possess patentable novelty.

Courts will take judicial notice of mechanical devices of common knowledge.

Although the patentee was the first to conceive of the convenience and utility of a mechanism for opening and closing the gates of railway car platforms, his right to a patent must rest upon the novelty of the means he contrived to carry his ideas into practical application.

It rarely happens that old instrumentalities are so perfectly adapted for a use for which they were not originally intended as not to require alteration or modification for such use; but if the changes involve only the exercise of mechanical skill, they do not sanction a patent.

The mere duplication of a device for operating a gate for the platforms of railway cars, whereby the gates of two adjoining platforms may be operated simultaneously, does not require invention.

The first five claims of letters patent No. 288,494, granted November 13, 1883, to William W. Rosenfield, for an improvement on railway car gates, declared void for want of patentable novelty.

### Luminous Printing.

An Italian has, it is alleged, invented a luminous printing ink that renders it possible for newspapers to be read in the dark. What a luxury it will be, when one is restless at night, to be able to take up a book or newspaper and read himself into a somnolent condition, without the trouble or danger attending other lights!

Luminous cards are not unusual, and the reader may not be surprised at some future time to find himself able to read his SCIENTIFIC AMERICAN at night, without other light than its brilliant pages will reflect. Stranger things than this are constantly occurring in the invention line.

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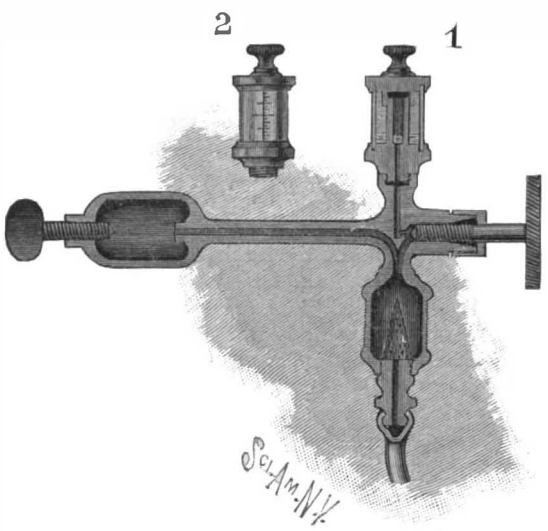
### MIXING AND VAPORIZING DEVICE FOR INHALERS.

This device—the invention of Mr. G. E. Johnson, of Albion, Ind.—is designed for thoroughly mixing anæsthetics, such as nitrous oxide and laughing gas and ether, at the time they are being used. The neck of a cylinder containing nitrous oxide is held in a yoke formed at one end of the tube in such a way that the gas can pass into the bore of the tube. The inner end of the bore is curved downward, and leads into a chamber the lower end of which is connected by a tube with a gasometer. Projecting upward from the bottom of the chamber is a wire gauze cone, which insures the perfect mixing of the gases as they pass through it. On top of the main tube is held a glass vessel having a screw cover and a gauge, as shown in Fig. 2. From this vessel the bore extends down to a bore in a neck on the end of the tube; a passage also leads to the chamber. In the neck is a screw valve. The anæsthetic liquid is contained in the glass vessel. By properly turning the screw valve, a small quantity of the liquid is permitted to flow into the chamber, where it is thoroughly mixed with the gas; it then passes through the tube into the gasometer.



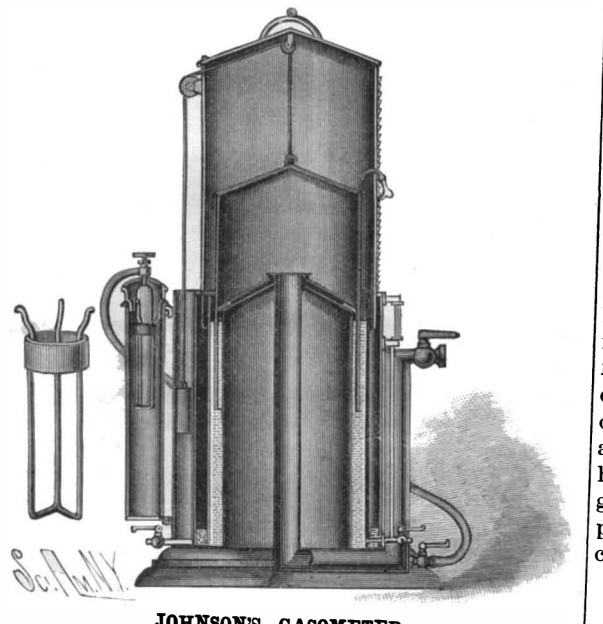

MIXING AND VAPORIZING DEVICE FOR INHALERS.

### GASOMETER.

[redacted] or dental [redacted] illustrated is to [redacted] by dentists and others to produ[redacted] nitrous gas. Secured to the side of the outer shell by hooks is a case containing a tripod frame—shown in the small view—for holding the nitrous oxide cylinder, which is connected by a hose with a cock on the inlet and outlet pipe; when the tripod is removed, a larger cylinder can be passed into the case. The valve of the cylinder containing the liquefied gas being opened, the gas passes through the hose and pipe into the bell, which is raised and locked in place by a catch engaging with teeth of racks formed on the outer shell, which is provided for the purpose of covering the bell when the latter is raised.

As the bell ascends, the weight attached to its top by a cord leading over suitable pulleys descends. The sides of the bell enter the water in a well formed by two cylindrical casings united at the bottom and secured to a base. Between the edges of the double conical top of the inner casing is held a rubber packing which rests against the inner surface of the bell. When the desired quantity of gas is in the bell, the oxide cylinder is closed and the hose uncoupled. To administer the gas, a flexible tube provided with a mouthpiece is coupled on the end of the outlet pipe, and the latch is raised to permit the bell to descend to exert pressure on the gas. Scales are provided, which show how much gas is in the bell and how much has been removed; a glass gauge shows the level of water in the well. The space between the outer well casing and the outer shell serves to catch the water that is forced out of the well.

This construction provides a dry gas chamber, and the water forming the seal cannot absorb much gas. The gasometer is small in relation to its capacity, and weighs very little. This invention has been patented by Mr. G. E. Johnson, of Albion, Ind.

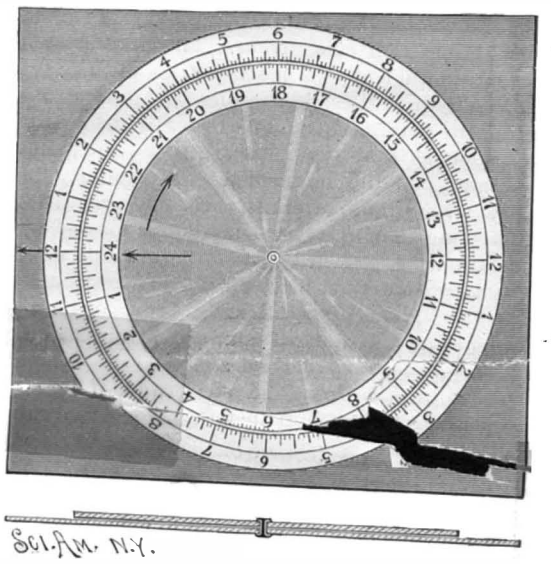



JOHNSON'S GASOMETER.

### TIME CALCULATOR.

This invention provides a simple and easily operated device for the use of time keepers or foremen in manufacturing establishments, to enable them to readily calculate the amount of time consumed by any workman upon any job. A circle in the plate forming the body of the instrument is divided into twenty-four equal parts, representing the hours of the day; each division is subdivided into parts of the hour. The circle is divided into halves, and the divisions in each half are numbered from 1 to 12. Opposite the twelve mark at one side is an arrow to indicate the starting point. Pivoted to the plate is a circular disk similarly divided, but the divisions are numbered from 1 to 24 in the reverse direction. Opposite the twenty-four mark is an arrow.

Suppose, for example, the workman quit at half-past one. The index on the disk is then moved to a point opposite the half-past one mark upon the upper half of the outer circle. He began work at half-past eleven. Now, by following the graduations of the upper half of the scale backward to the mark representing half-past eleven, it will be seen that the mark on the disk opposite half-past eleven is numbered two, thereby indicating that the workman had been employed two hours. It will be seen that the device is simple and easy to handle, and gives perfectly accurate results.




STRECK'S TIME CALCULATOR.

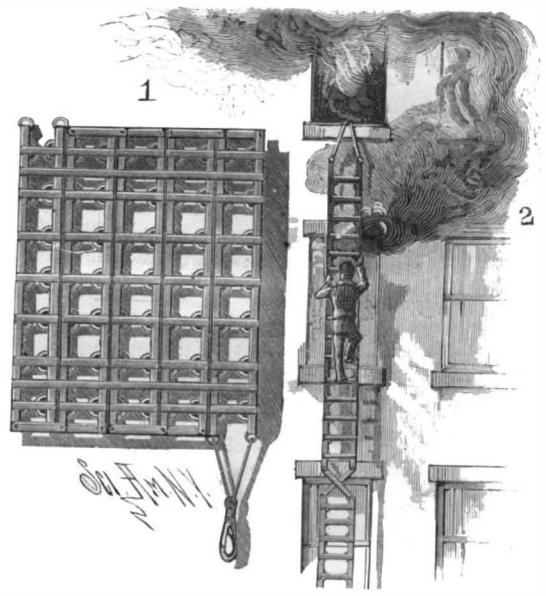
This invention has been patented by Mr. S. S. Streck, of 309 Coliseum Street, New Orleans, La.

### Medical Attendance for Railroad Hands.

The New York elevated railroads have some 4,000 employes, including about 500 repair men, constantly on duty. This is an extremely large proportion of labor for repairs and track inspection, which is necessitated by the peculiar character of the road, and it is a kind of work where the men are particularly exposed to accident and to injury to their eyes. The managers have, therefore, established a regular medical department, with one doctor for the eastern and one for the western division of the city lines, with facilities for prompt communication with any portion of the track. The company pays where men have to be taken to hospital, but its own doctors attend to the slight injuries, which are very numerous. A large satchel, with instruments, bandages, etc., stands ready for emergency, and is carried by the surgeons on duty. Among other functions discharged by the surgeons is the examination of employes for color blindness, sight, and hearing. Those not considered in sound condition are given other and less important positions, where these physical qualities are of less consequence. This medical attendance is without charge to the employes.

### COMBINED SPRING BED AND FIRE ESCAPE.

When necessary, the spring bed shown in Fig. 1 can be unfolded and used as a fire escape, as illustrated in Fig. 2. The apparatus is made up of several sections hinged together at their ends, so as to be folded alongside of each other to form a bed bottom, or extended to stand endwise to each other to form a ladder. Each section is composed of two upper and two lower parallel bars or plates, upper and lower cross plates, and springs held between the bars. The sections are hinged together end to end by upper crossed hinge plates that join the ends of the upper bars and lower cross hinged plates that join the ends of the lower bars. The sections can thus be folded side by side, or extended to form a ladder. When folded, they are held from spreading apart by two binding plates formed with downwardly projecting arms at their ends to reach over the outside edges of the outside sections, and also with arms to reach down between the adjacent edges of the sections. One of the outside sections is attached to any stationary object in the room by means of a strong cord, so that when the apparatus is cast out of the window, it will be securely suspended from the sill. The cross pieces of the sections constitute the rounds of the ladder.

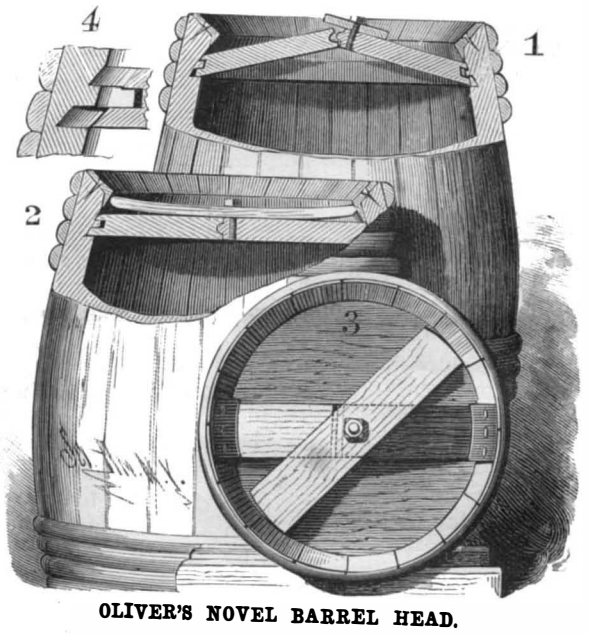



COMBINED SPRING BED AND FIRE ESCAPE.

This invention has been patented by Messrs. W. G. Wilson and G. Zimmermann; the latter, whose address is 2165 Oldam Street, Philadelphia, Pa., will furnish further particulars.

### A NOVEL BARREL HEAD.

The accompanying engraving represents an improved barrel head—the invention of Mr. Francisco J. Oliver, of 43 Cheever Place, Brooklyn, N. Y.—which can be easily placed and locked in position on a finished barrel, or removed from the same without disturbing the hoops, so as to facilitate the inspection, filling, or emptying of the barrel. The head is made in three pieces. The center piece is made in two parts, one of which has on its inner end a projection that fits into a corresponding groove in the inner end of the other part. The form of the beveled periphery of the head and of the corresponding croze in the barrel is plainly shown in the cut; a packing of rubber or other suitable material is placed in the groove of the head; the double joint t[redacted] and well fitting head. To place the head in position, the side pieces are inserted in the usual way, and then the bevels of the center pieces are placed in the croze directly under shoes fastened to the upper edges of the staves and projecting slightly inward. The inner ends are then fitted into each other, and the two parts are pressed downward to form a straight piece, thereby completing the head. The locking plate, through which passes a bolt secured to the inner end of one of the center pieces, is then placed transversely over the center part, the bolt passing through an aperture. The plate is then turned so as to cover the center piece, and its ends are placed under the shoes. The nut is then tightly screwed on the bolt against the plate, whereby the entire head is firmly locked in place. The head is removed by first unscrewing the nut, swinging the plate from under the shoes, and then, with the bolt as a handle, raising the center pieces. This head is strong and durable, since it is of the same thickness all over, and it requires no skill to handle it.




OLIVER'S NOVEL BARREL HEAD.

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### Frozen Fish.

The notice of frozen fish in the SCIENTIFIC AMERICAN of March 20 recalls a similar occurrence under my own observation. Several winters ago I purchased in one of the Hartford, Conn., fish markets three frozen pickerel, and carried them home at night. They were frozen perfectly hard and stiff. I placed them in a large tin pan, and filled it with cold water. In the morning my attention was attracted by a flopping at the pan, and I found one of the fish was splashing about as lively as when he first took the bait.

J. H. L.

### STEAM DISINFECTER FOR USE IN HOSPITALS.

The importance of having efficient means at command when an epidemic of contagious disorders breaks out in a populous place has been so abundantly proved in this and other countries that great attention has been drawn to the subject, with the view of securing

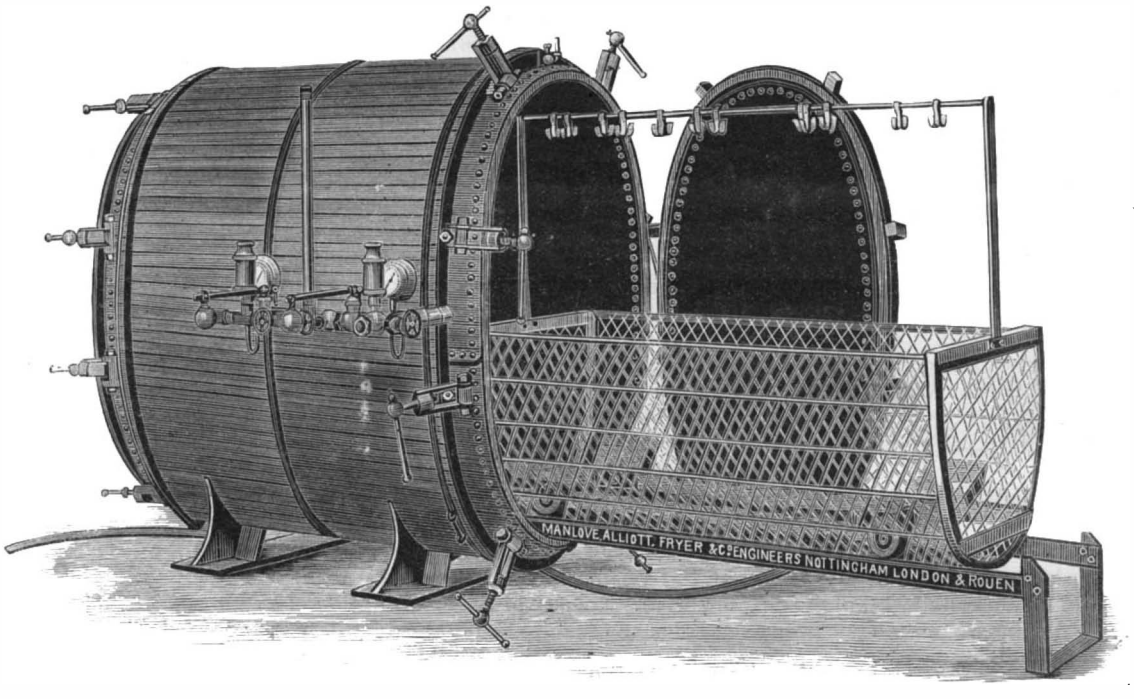
DIAL OF THE CHAMPION DOOR LOCK.

CHAMPION FLUSH DIAL CHEST LOCK.

the best disinfectant. It has been found by high scientific authorities, says the *Universal Engineer*, that heat alone, without the aid of dangerous chemicals, is sufficient to destroy all the germs of disease, all forms of insect life and low organisms, etc.; and the introduction of steam under regulated pressure into a properly constructed apparatus appears the safest and best method for hospital authorities, etc., to adopt.

Washington Lyon's patent steam disinfecter, as made by Manlove, Alliott, Fryer & Co., of Nottingham, appears to offer a thoroughly practical and efficient means of dealing with bedding, carpets, clothes, etc., without any injury to the fabric and no material damage to colors, as letters and papers can be disinfected without risk of damage. As will be seen from the engraving, the apparatus consists of a large and strong iron chamber, with double walls of boiler plate, provided at each end with a steam-tight door. The chamber is made elliptical in section, to enable large spring mattresses, couches, or bulky articles to be inserted without requiring to be doubled up. Steam from a boiler is admitted into the hollow casing to heat the walls of the chamber. While this is going on, the articles to be disinfected are placed in the traveling cage and rolled into the chamber, the door secured by screw clamps round the edge, and the steam by another pipe admitted to the interior of the chamber at 20 lb. pressure.

The temperature and pressure are regulated by valves and gauges outside, the degrees of temperature corresponding to the several pressures marked on the dial. By employing a higher pressure of steam on the outer casing than in the interior chamber the steam in the latter can be superheated, and consequently dried, preventing the condensation of moisture in the articles while being disinfected. The most approved method of fixing is to place the apparatus midway between two chambers; goods received in one chamber after disinfection are taken out into another chamber, to wholly prevent any contact between the infected and disinfected articles. For rural districts a portable apparatus, with boiler attached, can be made, but a fixed machine in a central position of a district is the best way. The apparatus has been definitely adopted by the Government, by the Metropolitan Asylums Board, many corporations, and the Government of China have ordered one to be sent to Hong Kong, so that it has successfully passed the experimental stage, and is an acknowledged method of disinfection.




STEAM DISINFECTER FOR USE IN HOSPITALS

### THE "CHAMPION" KEYLESS LOCKS.

Our usual expression for security is that we have placed valuables "under lock and key," but as the lock may be picked and the key lost, this does not always describe the best fastenings. In some of the improved "Champion" locks there is neither key nor key hole. Doors provided with them may be opened from either side, the "Open Sesame" being a knowledge of the combination of figures by which the knob may be made to turn and the door open.

Several forms of these keyless locks are manufactured, the shapes varying according to the purpose for which they are to be used. We illustrate the two forms which will be of more particular interest to builders. The first, known as the "Champion" flush dial chest lock, will be found of much value in protecting a fine set of tools or other shop valuables from theft or the inconvenient curiosity of visitors or borrowing by associates.

As its name implies, the lock is let in flush with the woodwork, that it may not be exposed to injury. It is made entirely of brass, with the dials nickel plated. To open a chest so fastened, it is necessary to know the three numbers which make up the combination. As the possible combinations are almost infinite, there is no chance of the secret being discovered. The numbers may be changed at pleasure, so that, should the combination become known to any undesirable person, it is a simple matter to change it. In construction, the lock is strong and reliable, and being so much more simple, it can be opened in much less time than an ordinary safe.

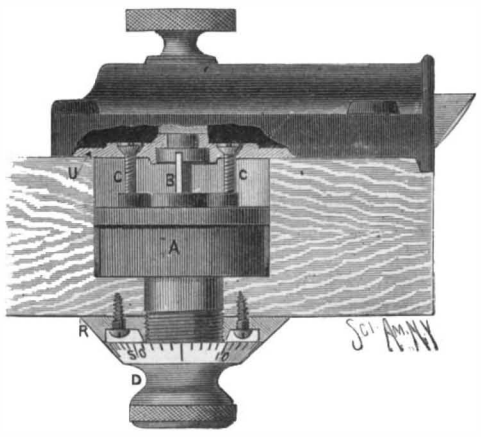
Perhaps it may be feared that the combination might be forgotten, but it must be remembered that a key is not only liable to be left behind, but as well to be lost or duplicated. The combination necessary for the unlocking of a keyless lock may be recorded in any number of places, and in such a way that detection would be impossible. The beveled form of the numbered dial is considered preferable for a great many purposes, but these minor details are susceptible of a large variety of designs.

The second lock illustrated, the "Champion" keyless door lock, is, we believe, the first keyless dial lock applied to a wooden passage door. We show it in section, and also the outside and interior parts, which are visible when it has been applied to door. The difficulty heretofore has been to control the fastening from both sides. As now arranged, the door may be opened from either side, and the lock may be put in place with little trouble. The section shows its construction.

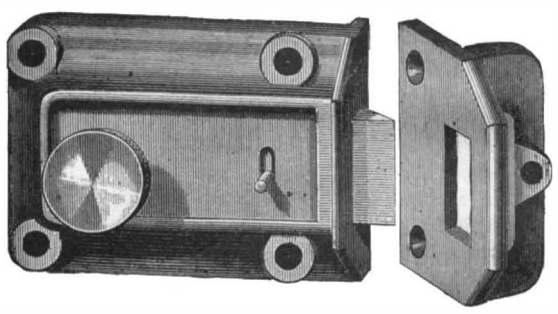
The smaller part of the cylinder, A, is screwed into the ring, R, on the outer face of the door. The spindle is then put in, and the under plate, U, of the bolt case is laid against the inner face of the door. The screws, CC, secure this plate to the cylinder, A. The lock is adjustable to any door. The mechanism by which the dial piece, D, operates the bolt is connected with the bar, B. Before the case is put on, the combination is to be set, in a manner described in the directions accompanying each lock.

By means of the latch shown on the inner side of the case, the bolt may be "thrown off", as in ordinary night latches. But a single revolution is required preliminary to unlocking, and the combination is made directly by turning at once to each of the three numbers. The simplicity and strength of the lock adapt it for use in the best houses. The dial, shown full size in our illustration, may be either nickel plated or bronze.

The Champion locks are, for the most part, the invention of Milton Jackson, now Manager and Treasurer of the Miller Lock Co., of Philadelphia, who are the sole manufacturers, and to whom all further inquiries should be addressed.




CROSS SECTION OF CHAMPION KEYLESS DOOR LOCK.



INSIDE LATCH OF CHAMPION DOOR LOCK.

### The Fattening Effect of Chewing Gum.

A Southern paper (*Macon* (Ga.) *Messenger*) says: "Twenty years ago the rule was that Southern women were thin and delicate; it is not the rule now. Southern women are not physically equaled in all North America. Any physician who is as well informed as he ought to be will tell you that this is true. This change is due to the habit of chewing gum. You may smile, you may even laugh, if you please, but I am telling you a plain fact. As to Southern men, they are as thin and gaunt as they ever were, and so they will remain until they cease to chew tobacco and begin to chew gum."

### Liquid Carbonic Acid.

A patent recently taken out proposes to produce the carbon dioxide gas for liquefaction by having a solution of sodium bisulphate in a leaden container, and running into it some carbonate or bicarbonate, dissolved or suspended in water, the evolved carbon dioxide being drawn off over a drying mixture into a gasometer, from which it is drawn for liquefaction by compression. Liquid carbonic acid, equal to 500 liters of gas at ordinary pressure, can be supplied for one shilling. In using this for various purposes, it is proposed to pass the gas that escapes after using over moist sodium carbonate, which is thus converted into bicarbonate, which can be again used as a source of supply of the carbon dioxide. There is a bore hole near the village of Burgbrohl, on the Rhine, which yields a constant supply of very pure carbon dioxide. This village is near to the Lake of Larch and the interesting volcanic district surrounding it, where there are a very large number of mineral springs and exhalations of carbon dioxide. This bore hole was sunk some two years ago, and has given a constant supply of gas amounting to about 2,160 cubic meters per twenty-four hours. Apparatus has been erected for liquefaction of the dioxide, and this is now regularly carried on close to the bore hole. The water which rises with the gas is very cool, and is employed to cool the compressing apparatus. About 500 liters of gas are compressed per minute into about one liter of liquid. This is sent away in wrought iron vessels containing about eight liters.

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### The Currents of the Atlantic Ocean.

We read, and we see it everywhere repeated, that the climate of Norway, which is mild as compared with that of the American coast in the same latitude, is due to the influence of the Gulf Stream. This is the common opinion shared in by a large number of competent persons in France and elsewhere. The public, in its turn, goes still further, and attributes the mildness of the temperature on certain portions of the French coast to the same cause, that is to say, the warm currents of the sea.

It is nowadays generally agreed that the Gulf Stream is soon lost on the surface of the Atlantic, and an endeavor has been made to refer the heating action, which it thus could no longer possess, to another current that forms a sort of continuation of it, and which, after all, is nothing more than a slow movement of the surface waters of the ocean from the east toward the west. Hence the question of heating through a slowly moving mass of water becomes very problematical, and there is now an opinion forming which would attribute the calorific influences formerly ascribed to the Gulf Stream to an atmospheric circulation, and not to an oceanic one.

The circulation of the ocean nevertheless presents considerable interest, and the reason that the question has not been more fully studied is because such researches require large pecuniary sacrifices, on account of the vast field to be covered.

A contribution to our knowledge of this subject, however, has recently been made by Professor G. Pouchet, who, through the liberality of the city of Paris, and the co-operation of Prince Albert of Monaco, was last year enabled to undertake some experiments. Prince Albert's sail yacht, the Hirondelle, which had been placed at Professor Pouchet's disposal, was fitting out at Lorient, and it became necessary to make haste, and, in a manner, improvise the apparatus to be used. The following three forms of floats were decided upon: 1. Ten copper spheres, one foot in diameter, formed of two hemispheres screwed upon a rubber joint. 2. Twenty kegs similar to those used for beer, and of a capacity of 3½ gallons. 3. A hundred and fifty ordinary bottles, closed by a selected cork, and capped with rubber. Each float contained a request, printed in French, Russian, Norwegian, Danish, English, German, Dutch, Spanish, Portuguese, and Mangrabin, that the finder of it would send the inclosed paper to the authorities of his country, in order that it might be sent to the French government, with details as to the place and date, and the circumstances under which the float was picked up.

The Hirondelle, having on board the material for the experiment, set sail about the first of July, 1885. It was agreed that the floats should be put into the sea to the northwest of Corvo, the last of the Azores. On the 27th of July, at a quarter past six in the morning, the vessel being about 110 miles northwest of Corvo, the putting of the bottles into the ocean was begun, and was kept up, mile by mile, till forty minutes past three, when a beginning was made with the kegs, and afterward with the spheres. These two latter styles of floats were spaced two miles apart, and the last of them was thrown over on the 28th. Then the second series of bottles followed. The floats were distributed over a line which ran about 14° north by east, and was 170 miles in length.

The place that had been selected in advance for the operation, and where Prince Albert accomplished the latter so happily, is situated almost exactly upon a line which joins the Strait of Florida (through which the Gulf Stream enters the Atlantic) and the entrance of the British Channel.

It was Prince Albert's opinion that if any of the floats reached the coast of Europe, it would be between 40° and 50° of north latitude; but up to the present no such thing has occurred. Three of the floats were picked up, after a travel toward the east, in which they at the same time strangely inclined toward the south. Two bottles and one keg were found at the Azores—one of the bottles 10 miles off the port of Saint Iria, San Miguel Island, one a mile east of Porto Formoso of the same island, and the keg at the port of Porto, Santa Maria Island.

The two bottles had taken 53 days to travel a distance of 420 miles. The keg, which stranded on Santa Maria, seemed to show that the floats were continuing their course toward the south. It is allowable to suppose that the floats, after turning the Azores, continued to travel in the direction of the Cape Verd Islands, in order to cross the Atlantic and directly reach the Antilles, or to revolve indefinitely in the immense and pacific whirlpool called the Sargasso Sea. However this may be, the positive although partial results obtained seem to establish the fact that from the latitude in which the floats were thrown overboard, not a drop of the Atlantic's surface water reaches the coast of France. This is a point that now appears to be demonstrated. If we admit that there exists a current or simply a shifting of the warmer water from the west toward the east on a level with the coast of France, it is, then, to the north of the 42d parallel that we must look for the origin of the heating of this water. Every one now appears to argue that the Gulf current no longer makes its influence felt beyond the 40th degree of latitude. In reality, outside of its sphere of action, which is now well known and has been perfectly measured, it seems that the motion of the superficial water of the Atlantic between the Azores, the Cape Verd Islands, and the Antilles is in great measure a function of the movements of the atmosphere. On comparing the travel of the floats with Brault's wind charts for July, August, and September, it was found that their direction sensibly agreed with that of the current that carried the floats along.—*Condensed from Le Genie Civil.*

### Insomnia in the Aged and its Treatment.

In opening a discussion on this subject, Dr. C. L. Dana said that he had found the information contained in the text-books upon insomnia in the aged was very slight in amount. Insomnia was not frequent in the aged, but when it was present it was sometimes very intractable. Pathologists thought it was due to anæmia and mulnutrition. The thickened arterial walls and the high arterial tension from the contracted kidneys, and similar states, which were found in the aged, would indicate that the blood supply to the brain was deficient. The insomnia produced by anæmia was characterized by drowsiness during the daytime, the patient falling into little naps, while at night he was unable to obtain any rest. This was true of the young as well as the old. If in any case we found no actual disease, it was customary to try iron and rich diet. In the speaker's experience, however, iron did not relieve the anæmia of the aged so as to produce sleep. Alcohol with the food was another remedy, and many recommended hot gruel or hot milk with alcohol before going to bed. While alcohol would relieve some cases, there were others in which the insomnia was increased.

The bromides and chloral, even when given in enormous doses, often failed to give relief. Opium was another remedy. Dr. H. C. Wood had recommended that we make our aged people opium eaters and alcohol drinkers. The speaker had not found that opium always agreed with the aged, and in his experience, where opium had produced sleep, it was sometimes followed by such physical and mental depression as precluded its further use.

He had been disappointed in bromide and chloral, and considered the results of opium sometimes disastrous. He recommended good food, warm drinks at night, and small doses of codeia with cannabis indica. Valerian and lavender, hyoscyamine, and lupulin sometimes were also useful drugs.—*Bulletin of Clinical Society, N. Y. P. G. M. S.*

### Motive Power for War Ships.

On this subject Chief Engineer N. B. Clark gives some good suggestions in the *Army and Navy Journal.*

The swift passenger steamer requires engines which will develop power with the utmost economy at the high speed at which they are constantly run, without regard to economy of fuel at low speed. As the war ship consumes by far the greater part of her fuel supply (probably 95 per cent) at low speed, economy of fuel at that speed is a very important factor in the design of her engines.

As it would require about eight times the power to drive a vessel 18 or 20 knots that it would to drive her 9 or 10, it will be seen that engines designed for economy at high speed would not develop power with economy at low speed, as there would be great loss from friction and radiation incident to a large engine developing a small power.

At the present time, the steam machinery of war ships is patterned after that of the merchant service, inasmuch as it is so excessively heavy that, if sufficient horse power is applied to attain high speed, the ship is so loaded down with steam machinery that but little weight-carrying capacity is left for anything else.

The average weight of the steam machinery of the British Navy is 360 lb. per I. H. P., with 289 lb. for the Iris and Mercury, and 180 lb. per I. H. P. for the torpedo ram Polyphemus, and only 57·7 lb. per I. H. P. in the existing first-class torpedo boats, while the steam machinery of the Chicago is 419 lb., and that of the Boston and Atlanta is 448 lb. per I. H. P.

The difference between 57·7 lb. in the torpedo boats and 448 lb. in the Boston and Atlanta seems to be a high price to pay for economy in the consumption of a small percentage of the fuel, to be obtained by its use, on rare occasions, for short periods of time, particularly when we consider that this ponderous machinery itself has to be carried at the high speed, and that additional power must be applied to overcome the resistance incident to its weight.

The remedy for this state of affairs is the application to war ships of the light-running, rapid-moving engines, constructed entirely of steel and bronze, similar to those applied to the torpedo boats, whereby great strength and power are obtained on a light weight, and by a division of the power among separate engines, so as to disconnect a part when running at low speed.

Such engines, if increased in weight to 115·4 lb. per I. H. P., or 100 per cent, would have ample endurance for the emergency power of a war ship, would develop power at low speed, with the utmost attainable economy, and would by their light weight permit of the application of sufficient power to attain a high emergency speed.

For the sake of illustration, we will take the hull of the British dispatch steamer Mercury, of 3,735 tons displacement, which has made a speed of 18·87 knots, with 7,500 I. H. P., having steam machinery weighing 968 tons. If the far lighter machinery, weighing 115·4 lb. per I. H. P., was applied to the Mercury, the same power would weigh but 386·4 tons, thereby gaining 581·6 tons, which, if applied to water line defense and V gun-shields, would produce a swift vessel, with great sea endurance, invulnerable to shot and shell.

Referring to the British torpedo boat Childers, we find she has compound engines 8½ ft. high, with cylinders 14 in. and 24½ in. in diameter, and 15 in. stroke of piston. If these engines were amplified to 1,875 I. H. P. their cylinders would measure 19½ in. and 34 in. diameter, with 21 in. stroke of piston, and would be 11·9 ft. high.

If two such engines were applied to each screw shaft of the Mercury, she would have machinery capable of developing a high emergency power, and of running with great economy at a low speed, thereby augmenting her sea endurance, as but one set of compound engines would be used in each shaft—the others being disconnected—thereby avoiding the great loss from friction and radiation incident to a large engine developing a small power.

Light-running, swift-moving engines, analogous to those of the torpedo boats in many features, are now being generally applied in industrial establishments, displacing the heavy, centrally located engine formerly used—the smaller engines being applied directly to the machine to be run, instead of running shafting to the machine, thereby avoiding the loss from friction and radiation due to running a large engine to produce a small power, when there is no more required.

The great power developed by the torpedo boat type of engines is due to their high piston speed, which is over 1,000 ft. *per minute;* but as the steam enters the cylinder at a speed of 1,600 ft. *per second,* it will be seen a still higher speed, and consequently greater power, might be developed, if it was not for the racking effect produced by the great momentum of the reciprocating parts.

The momentum of the reciprocating parts is measured by their weight multiplied by the square of their velocity, consequently a decrease of weight would admit of a higher piston speed and greater transmission of power by the same engine.

An aluminum bronze can be made having the same strength as the best steel, with only one-third its weight; and if the reciprocating parts of the engines described, consisting of the pistons, piston rods, connecting rods, and crank pin brasses, were made of this metal, the piston speed, and consequently the power transmitted, might be increased almost 75 per cent, without any increase of momentum.

The weight of reciprocating parts of an engine of the type and proportions of that of the Childers, if amplified to 1,875 I. H. P., and augmented in weight 50 per cent, which would be sufficient for those special parts, would, if made of steel, be 1,507·5 lb. If made of aluminum bronze of equal strength to the steel, the weight would be only 502·5 lb.

If the engines were run at the same piston speed that is now attained with steel, and the 75 per cent increase of power, made available by the use of the lighter metal, was held in reserve for a great emergency, they would possess remarkable powers of endurance.

### A Grand Donation to the National Museum.

Dr. C. V. Riley, Entomologist of the Department of Agriculture and Honorary Curator of Insects in the National Museum, has presented to the National Museum his extensive private collection of North American insects, representing the fruits of his labors in collecting and study for over twenty-five years. His collection contains over 20,000 species, represented by over 115,000 pinned specimens, and much additional material preserved in alcohol or other methods. It is estimated by those familiar with the collection to have a money value of at least $25,000. In addition to the actual cost of material, it is hard to estimate the amount of time and labor that such a collection represents. In acknowledging the donation, Professor Baird expresses the warmest appreciation for this most generous gift, and his assurance that both now and in the future it will afford a valuable means of study for the entomologists of this country. This collection is especially rich in Coleoptera and Lepidoptera, and the latter contains many rare larvæ, blown and in alcohol. As it stands, says the *American Naturalist,* by this gift the entomological collections of the National Museum become next in importance to those at Cambridge.

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## Correspondence.

### Liming Wood to Prevent Fire from Steam Pipes.

*To the Editor of the Scientific American:*

I have read much in your valuable paper about "Fires from Steam Pipes." We have many steam pipes in contact with wood, and have tried the use of lime on the wood coming in contact with the pipes. I coated the pipes where they touched any wood, and found that several coats of lime or whitewash was a good preventive against charring of the wood.

LOUIS J. SEHRING.

Joliet, Ill., Feb. 23, 1886.

### Fire from Steam Pipes.

*To the Editor of the Scientific American:*

I am surprised to read a letter on the subject of fires caused by steam pipes, in the SCIENTIFIC AMERICAN, dated Jan. 30, 1886, signed by E. P. Clark, stating that it is impossible to set wood on fire with steam pipes working at any reasonable pressure.

A few years ago I was in the city of Toronto, and as business took me to one of the largest distilleries in that city, I happened to notice several men opening what appeared to be a covered drain. On looking into it, I saw a steam pipe about two and a half inches running through it from the boiler room to the cattle sheds, several hundred yards away. The steam pipe, when it was put there, was covered with wood, or I should say that the iron pipe was laid through a large wooden one several inches in thickness, for protection. When the earth and the covering were taken off the trench, all that remained of the wooden pipe that surrounded the iron one was a pile of charcoal, and as good a sample of charcoal as I ever saw; the wood was all gone. Some places the charcoal lay on the pipe as well as underneath it. The trench being covered with earth made it air tight; that I expect accounts for the wood burning to charcoal by the hot steam pipe. I hope this will satisfy persons interested in the matter that hot steam pipes will set wood on fire, especially when they are closely covered.

JOSEPH DIX, JR.,
*Master Mariner.*

Kingston, Canada, March 20, 1886.

### Restoration of Magnetism by Heat.

*To the Editor of the Scientific American:*

To heat a magnet to a red heat has long been known to destroy its magnetism; but from a recent experiment of mine with two sound magnets that have from want of care lost nearly all their magnetism, I fully restored them by rubbing a red hot iron, ¼ inch, over them until it had become quite cool. The magnets are better now than when new. This experiment was prompted in my desire to prove magnetism bears to heat as close a relation as electricity. Thus we hope soon to be able to make a clearer demonstration.

CHAS. H. ROBERTS.

Troy, N. Y., March 30, 1886.

### Dilatancy.

To Professor Osborne Reynolds is due the credit of making a discovery which promises to be of some importance. The discovery appears to have resulted from experiment, guided as much by inductive reasoning as pure curiosity. It is, says the *Engineer*, a remarkable discovery, in that it was quite unanticipated, and is, indeed, apparently opposed to past experience. Of course, it is not really opposed, for nature does not contradict herself; but the precise conditions necessary have never before been secured properly by a philosopher, though no doubt they have been present scores of times when the philosopher was absent. The discovery, referred to at the last meeting of the British Association, was more fully described at the weekly evening meeting of the Royal Institution on the 12th of February. A special word has had to be coined for dealing with the discovery, which word we have used at the head of this article. The title of Professor Reynolds' paper given at length is "Experiments showing Dilatancy, a Property of Granular Material, possibly connected with Gravitation."

If we ask any of our readers what will occur if an India rubber bag containing sand and water, and communicating with a bucket of water by means of a tube, be pressed between two flat boards, the answer will be that the water in the bag will be squeezed out into the bucket. Broadly stated, Professor Reynolds' discovery is that this is not what will happen, but that, on the contrary, water will at once rise up the pipe from the bucket, and enter the bag. Paradoxical as it may seem, the bag becomes larger, up to a certain limit, the more it is squeezed. Professor Reynolds began his discourse by telling his hearers something about the mysterious ether by which light is transmitted to us from the sun; by shearing which in two, according to Dr. Lodge, we get electricity; the possible cause of cohesion and gravitation; an elastic, homogeneous jelly pervading all space, more rigid, in one sense, a million times, than cast steel, and yet so tenuous that it does not sensibly retard the motion of planets moving through it. Whenever a phenomenon presents itself which cannot be otherwise explained, it is referred to the ether, and there are nearly as many ethers as there are philosophers. It has been said, indeed, that no less than six different ethers are needed to satisfy the predicates of the vibratory theory of light. Maxwell found no comfort in the ethers; on the contrary, he maintained that they were like the glasses of the dram drinker—one always led to another, necessary to explain the existence of the first. "As the result," says Professor Reynolds, "of a long-continued effort to conceive a mechanical system possessing the properties assigned by Maxwell, and, further, which would account for the cohesion of the molecules of matter, it became apparent that the simplest conceivable medium—a mass of rigid granules in contact with each other—would answer, not one, but all the known requirements, provided the shape and mutual fit of the grains were such that, while the grains rigidly preserved their shape, the medium should possess the apparently paradoxical or anti-sponge property of swelling in bulk as its shape was altered."

No one ever dreamed that the cubic content of sand in a sack was affected by the shape given to the sack. Yet, now that we are told all about it, we wonder that we did not see the truth before. If the grains interlock, their alteration of form must, under given conditions, augment the space occupied. For example, if we shake or disturb a brick wall, it is evident that we increase its dimensions, because the bricks are no longer so close to each other as they were. In an ordinary mass of brickwork or masonry well bonded without mortar, the blocks fit so as to have no interstices; but if the pile be in any way distorted, interstices appear, which shows that the space occupied by the entire mass has increased, as was shown by a model. At first it appeared that there must be something special and systematic, as in the brick wall, in the fit of the grains together, but subsequent consideration revealed the striking fact that "a medium composed of grains of any possible shape possessed this property of dilatancy so long as either of two important conditions was satisfied." The conditions are that the medium should be continuous, infinite in extent, or that the grains at the boundary should be so held as to prevent a rearrangement commencing. All that is wanted is a mass of hard, smooth grains, each grain being held by the adjacent grains, and the grains in the outside prevented from rearrangement.

Professor Reynolds obtained the necessary conditions by using a thin India rubber bag holding six pints. This bag being filled with clean dry sand, such as is used for hour glasses, served for many experiments. The bag was coupled to one leg of a mercury pressure gauge, and it was only necessary to flatten the bag to make the mercury rise 7 inches in the leg next the bag; in other words, a partial vacuum was established by squeezing the bag. The reader will naturally ask what would take place if no air found its way into the bag by the way of the mercury. In that case, the resistance to squeezing would be much increased, and when water is used, which is non-elastic, the shape of the bag cannot be altered at all.

"Taking," says Professor Reynolds, "the same bag, the sand being at its closest order, closing the neck so that it cannot draw more water, a severe pinch is put on the bag, but it does not change its shape at all; the shape cannot alter without enlarging the interstices, these cannot enlarge without drawing more water, and this is prevented. To show that there is an effort to enlarge going on, it is only necessary to open a communication with a pressure gauge, as in the experiment with air. The mercury rises on the side of the bag, showing when the pinch is hardest—about 200 pounds on the planes—that the pressure in the bag is less by 27 inches of mercury than the pressure of the atmosphere; a little more squeezing, and there is a vacuum in the bag. Without a knowledge of the property of dilatancy, such a method of producing a vacuum would sound somewhat paradoxical. Opening the neck to allow the entrance of water, the bag at once yields to a slight pressure, changing shape, but this change at once stops when the supply is cut off, preventing further dilation."

Professor Reynolds has as yet drawn few deductions. He prefers to continue his experimental researches, and some of the results are very curious. "Putting a bag filled with sand and water between two vertical plates, and slightly shaking while squeezing, so as to keep the sand at its densest, while it still has a free surface, it can be pressed out until it is a broad, flat plate. It is still soft as long as it is squeezed, but the moment the pressure is removed, the elasticity of the bag tends to draw it back to its rounded form, changing its shape, enlarging the interstices, and absorbing the excess of water; this is soon gone, and the bag remains a flat cake, with peculiar properties. To pressures on its sides it at once yields, such pressures having nothing to overcome but the elasticity of the bag, for change of shape in that direction causes the sand to contract. To radial pressures on its rim, however, it is perfectly rigid, as such pressures tend further to dilate the sand; when placed on its edge, it bears 1 cwt. without flinching. If, however, while supporting the weight it is pressed sufficiently on the sides, all strength vanishes, and it is again a rounded bag of loose sand and water." By shaking the bag into a mould, it can be made to take any shape; then, by drawing off the excess of water and closing the bag, the sand becomes perfectly rigid, and will not change its shape unless the envelope be torn; no amount of shaking will effect a change. In this way bricks can be made of sand or fine shot full of water, and the thinnest India rubber envelope, which will stand as much pressure as ordinary bricks without change of shape; also permanent casts of figures may be taken. When we walk along a wet beach, around each footprint the sand is seen to change color for some distance. This is because the pressure of the foot has changed the shape of the mass under it, and the water is sucked in, drying the sand all around. It seems a paradox that instead of squeezing the water *out* of that portion of beach rigid under foot, it is sucked in.

Although Professor Reynolds has not drawn deductions, we cannot resist calling attention to one or two which suggest themselves. May we not find here the cause of rigidity? The bag of sand is stable, because to change its form would augment its bulk. May not a bar of steel be stable for the same reason? Our readers will not be slow, we think, to see that Professor Reynolds has left a good deal to be explained. For example, to state that a cake of sand and water is stable because a change of form would augment its dimensions, is only to reason in a circle. We naturally ask, Well, why should it not increase its dimensions? and to this Professor Reynolds supplies no answer. It is true that an increase in volume would lead to the production of a partial vacuum inside, and that in so far the pressure of the air outside would tend to promote stability; but this stability ought to be elastic or dynamic stability, not static. Concerning this, no doubt Professor Reynolds will have more to say. The apparatus required is extremely inexpensive, and there is no reason why a whole army of workers should not attack this subject with excellent results. Meanwhile, we may say that it has long been known to engineers that sand, unlike water, exerts under suitable conditions no lateral pressure. For example, bags of dry sand have been employed instead of wedges to carry the centering of bridges. The loads may be very heavy, yet these canvas bags will not burst. If the sand behaved like a liquid, they would be rent in a moment by a hundredth part of the load. To strike the centers, it is only necessary to open a small hole in a bag, and let as much or as little sand run out as may be needed. A paper plug will suffice to stop the flow.

### Germanium, a New Metal.

In the *Berichte der Deutschen Chemischen Gesellschaft* there is an account of a new metallic element discovered by Clemens Winkler. It occurs in argyrodite, a silver ore from the Himmelsfurst mine, near Freyberg. Germanium, symbol Ge, has a great resemblance to antimony, though it is distinguished by certain well-marked reactions. If the sulphide is heated in the absence of air, *e. g.*, in a current of hydrogen, it forms a blackish crystalline sublimate, which at a higher temperature melts to brownish red drops. This sulphide dissolves in ammonium hydrosulphide, and is reprecipitated with a white color by hydrochloric acid, and is again redissolved by ammonia. If arsenic or antimony is present, the color is yellow. If heated in air, or treated with hot nitric acid, the white germanium oxide is formed, which is not volatile at a red heat. The oxide dissolves in potassium hydroxide. If this solution is slightly acidified, it gives a white precipitate on treatment with hydrogen sulphide. The oxide is easily reduced by hydrogen; the sulphide less easily. The metal is gray, volatile at a full red heat, though less readily than antimony. The vapor deposits small crystals resembling those of iodine, which do not melt. In a current of chlorine the metal yields a white chloride, which is more volatile than antimony chloride. The acid solution gives a white precipitate with hydrogen sulphide. Herr Winkler is determining its atomic weight, with a view to determine its place in the periodic arrangement.

THE telephone is hardly a safe medium by which to convey news items to the printer. A Western newspaper related the incident of one of its townspeople—giving her name—having eloped with an eighteen year old man. In the next issue of his paper the editor apologized for his blunder by stating that the item was received by telephone, and should have stated that the woman was thrown from an eight year old mare.

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### A New Traveling Torpedo.

The details of moving torpedoes, as regards their steering power, propulsion, and explosive charge, have for some time past formed a special study with Mr. R. Paulson, who has effected what would appear to be some important improvements in these respects. Electro magnets are the chief agents used in the steering arrangements, although their exact construction and arrangement are points upon which the inventor prefers to preserve silence at present. So with regard to his improved means of propulsion and the explosive charge; the most that he is just now prepared to state publicly respecting these is that propulsion is effected by a system differing *in toto* from any of those at present employed.

Broadly stated, it consists in the use of chemically generated gas, which is utilized either for forcing a column of water direct astern or for causing it to actuate machinery for driving a propeller. The explosive charge consists of a species of gun-cotton possessing 50 per cent more power than ordinary gun-cotton, but having an equal degree of safety. The steering device is that upon which Mr. Paulson is most communicative, and this is stated to consist of two batteries, one pole of each of which is placed in connection with the coils of two sets of electro magnets, from which leads are conducted to two metal pins fixed on a disk of insulating material. Both the other poles of the batteries are placed in communication with a balanced magnetic needle of special construction. The metal pins are placed one on either side of the needle, and the course of the torpedo having been set, it is started. Any deviation of the torpedo from its assigned course causes a relative movement of the needle, which touches one or other of the pins, thus establishing the circuit through the coils of one or other of the two magnets. An armature connected with the rudder is attracted, and by this means the torpedo is again placed on its right course. The depth of immersion of the weapon is also regulated and maintained in a similar manner by a vertically balanced needle. Another feature is that the torpedo can be directed toward iron ships, irrespective of the predetermined course, by means of another balanced needle.

A demonstration of the steering powers of the apparatus was recently given by the inventor at 15 Cockspur Street, Charing Cross, a model torpedo, about 2 feet 6 inches long and 7 inches in diameter, being used. The model was not placed in water, but was swiveled on a stand, and it was clearly shown that when it deviated from the course upon which it had been laid, the electro magnetic arrangement—which was, of course, concealed within the torpedo—came into operation and restored it to its normal course. More could not be shown, but it was stated that a full sized torpedo, 16 feet in length and 14 inches in diameter, had been made and successfully tried on the coast in England. On the last occasion, however, the torpedo had managed to get away from its inventor, and had been no more seen. The material of which Mr. Paulson proposes to construct the shell of his torpedo differs from that hitherto used in that it is a species of papier mache, of a tough and fibrous nature.

The new weapon is to be discharged from the shore or from any ordinary boat, thus obviating the cost of a special torpedo boat. This feature points it out as valuable for coast and harbor defense, for which purposes it is the opinion of several naval authorities by whom it has been examined that it is especially adapted. In view of its apparent merits, it would appear desirable that the government authorities, who have had the matter under consideration for some little time past, should lose no time in constructing a torpedo of the proper working size and having it practically tested. This course is the less objectionable, seeing that the cost is stated to be only about £150. At any rate, the invention appears to justify prompt and thorough investigation, in order that its practical usefulness or otherwise may be ascertained.—*London Times.*

### Freezing and Melting Points of Water.

Although water usually freezes at 32 degrees F., and ice melts when above that point, the result is not uniform in either case. If water, for instance, be kept in a clean, smooth-sided vessel, and perfectly still, it is possible to keep it from freezing until it reaches a temperature of 15 degrees. Under other conditions such a temperature would produce half an inch of ice in a single night, thus clearly indicating the influence of motion on crystallization. If this water at 15 degrees be disturbed in the least degree, the crystals will at once begin to form, and simultaneously therewith the entire mass of water will gradually rise to 32 degrees and freeze solid. In the same way the presence of salt and acid in water retards freezing. Again, it has been ascertained by experiments that if water be boiled in a glass flask, and the neck of the flask be plugged with cotton, the water may be cooled down to 9 degrees F. before it will freeze. With regard to the melting point of ice, the temperature is more uniform, as the solid ice is not subject to the law of motion as water is, but there are ways of precipitating the melting of ice, as has been frequently tested. Thus, for instance, if a block of ice be subjected to a heavy pressure, the melting point can be reduced to 18 degrees F., a point which would produce sharp freezing in a stream or lake, where the ordinary laws of nature were not interfered with.

### ASTRONOMICAL PHOTOGRAPHY.

As a few experiments in celestial photography tried last year by means of quite rudimentary instruments gave good results, the Director of the Observatory has been pleased to authorize the construction of a special apparatus, which we illustrate herewith.

This new instrument consists of two juxtaposed telescopes inclosed in an oblong rectangular metallic case, and separated through their entire length by a thin partition. One of the objectives, of 9½ inches aperture and 12¾ feet focal length, is designed for visual observation, and serves as a finder. The other, of 11·4 inches aperture and 11¼ feet focus, is achromatized for chemical rays, and serves for photographing. As the optical axes of these two objectives are parallel, every star kept in the center of the ocular field of the first telescope produces an impression in the center of the sensitized plate of the photographic apparatus.

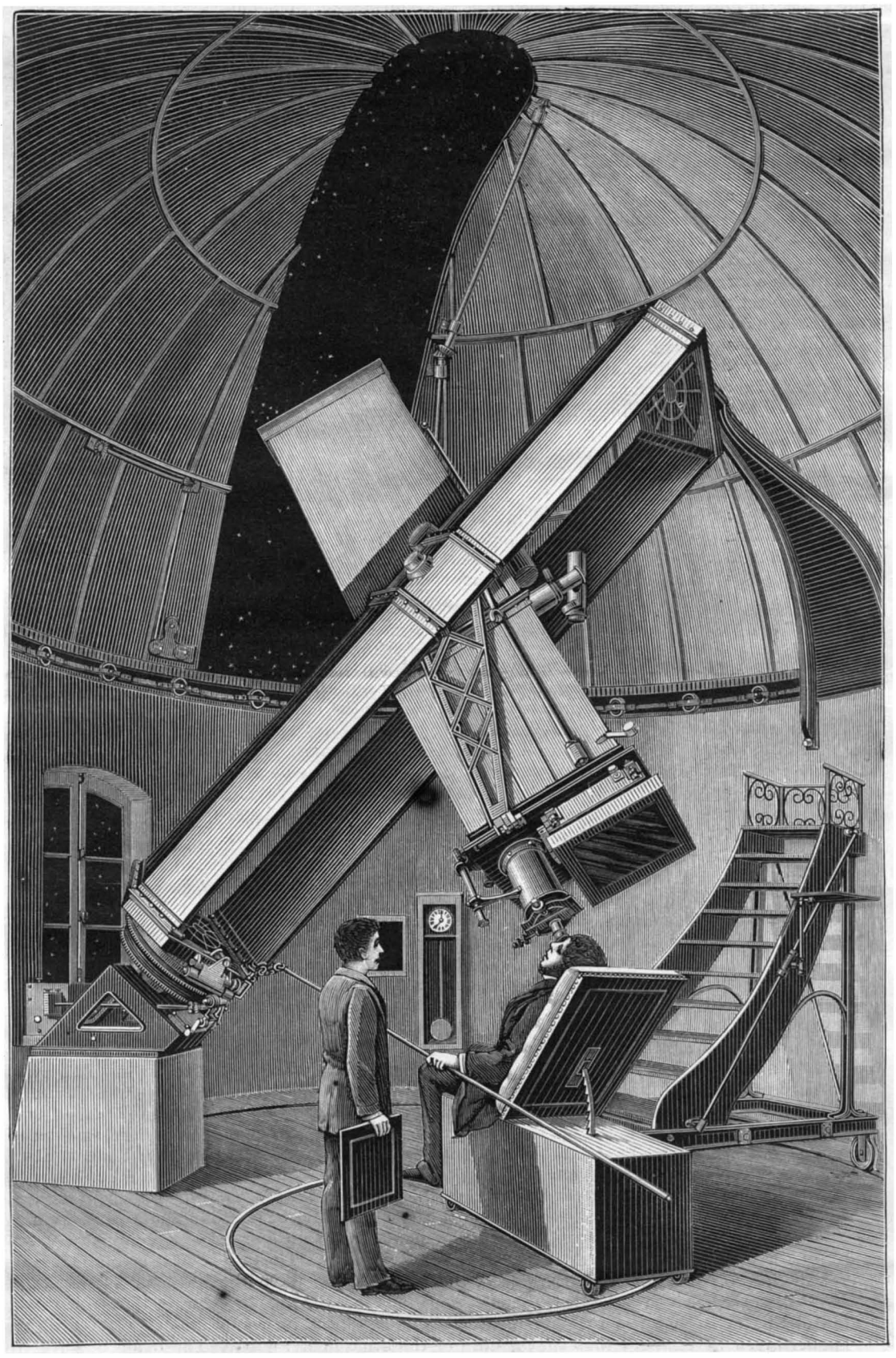

Fig. 3.—PARALLACTIC APPARATUS AT THE PARIS OBSERVATORY.

The equatorial is mounted after the English style, that is to say, the center of the tube always remains in the polar axis of the instrument. This arrangement permits of following up a star from its rising to its setting, without the necessity of turning back the instrument near the meridian, and, moreover, it has the advantage of giving the direct and inverse positions for every region of the heavens, thus allowing of the elimination of certain errors in centering.

Like a horary equatorial, it is provided with horary and declination circles, and a clockwork movement, which carries the apparatus along for three hours without rewinding. In addition, there are very slow, independent, back movements that permit of holding the axis of the telescope upon a given point of the heavens, in spite of any slight irregularity in the clockwork motion and in the setting of the telescope, or of variations in atmospheric refraction. The photographic objective, which is the largest that has hitherto been made, consists of a simple, achromatic system, and, although of extremely short focal proportions, is capable of covering a field three degrees in diameter without the use of a diaphragm.

Although it has been mounted but a short time, this apparatus has already permitted of considerable work being done. The very reduced chart shown in Fig. 2 is a specimen of what it is possible to obtain. In a surface representing an area of about five square degrees of the heavens, we can count more than three thousand stars of between the sixth and fourteenth magnitude, two only of which are visible to the naked eye. We can even distinguish in the negative traces of stars of the fifteenth magnitude, that are too faintly indicated to show up in the positive. Stars of the fourteenth magnitude exhibit themselves under a diameter of 0·00098 of an inch. It will be easily seen that points so small as these might be readily confounded with imperfections in the sensitized film, were not the precaution taken to make many exposures.

In the annexed chart, each star is formed of a group of three points forming an equilateral triangle, each side of which is no longer than 0·0033 of an inch. To the naked eye these three points appear to be confused into a single one; but, if we examine them by means of a strongish lens, the three exposures will become distinct, and it will then be easy to distinguish in the negative everything that does not belong to the heavens, and to eliminate it. By the ordinary processes, it would certainly have required a diligent labor of several months to obtain a chart such as we get here in three hours.

The time of exposure necessary for obtaining an image of the stars is as follows:

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1st magnitude, 0·005 s.; 2d magnitude, 0·013 s.; 3d magnitude, 0·03 s.; 4th magnitude, 0·08 s.; 5th magnitude, 0·02 s.; 6th magnitude, last stars visible to the naked eye, 0·05 s.; 7th magnitude, 1·3 s.; 8th magnitude, 3 s.; 9th magnitude, 8 s.; 10th magnitude, 20s., 11th magnitude, 50 s., 12th magnitude, 2 m.—mean magnitude of the asteroids; 13th magnitude, 5 m.; 14th magnitude, 13 m.; 15th magnitude, 33 m., 16th magnitude,

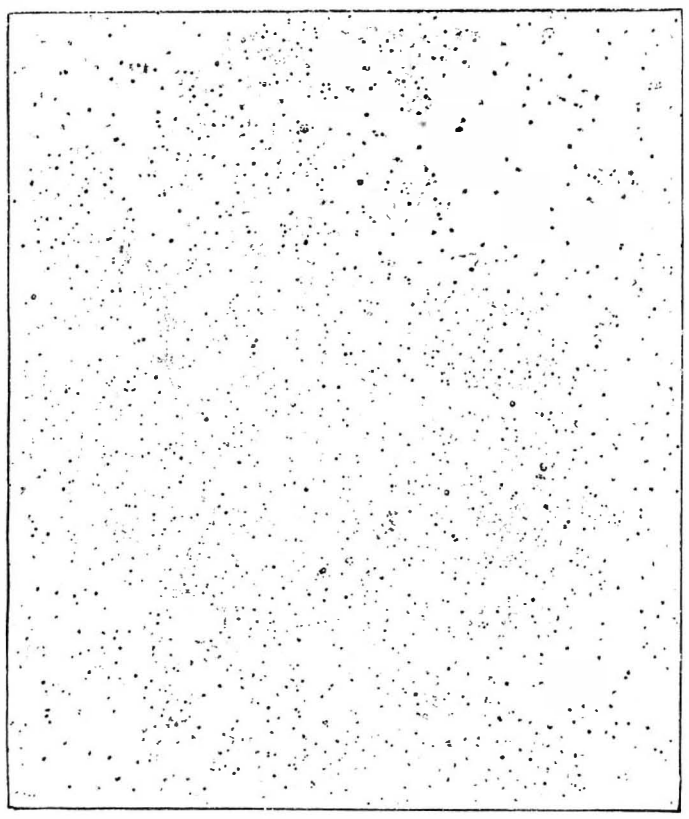


Fig. 2.—PHOTOGRAPH OF A PORTION OF THE CONSTELLATION CYGNUS.

1 h. 23 m.—last stars visible with the average of large instruments.

All these figures represent a minimum. In order to obtain good reproductions upon paper, the time of exposure must be tripled.

It will be seen from this table that between the first and last magnitudes the time of exposure varies from 1 to 1,000,000. (The proportion adopted between the brilliancy of two consecutive magnitudes is 2,512.)

Aside from the construction of celestial charts, we may mention as another very important study the discovery of asteroids, which has now become possible through photography. The small stars appear upon the negative as, so to speak, a mathematical point, while the planets are distinguished therefrom by a small, well defined dash that indicates their proper motion, with magnitude and direction, during the time of the exposure. It is thus that we have been enabled to obtain the track of a small planet of the eleventh magnitude, showing its course through an exceedingly well defined line amid the fixed stars. In the same way it is possible to study the motion of the satellites around their planet, and perhaps to discover new ones.

The study of double and multiple stars will be greatly facilitated, and it will be possible, likewise, to apply photography to researches on the parallaxes. Finally, we must cite photometry as one of the branches of astronomy that will now be enabled to collect very useful data through the use of photography.

Let us remark, in conclusion, that this recent progress has perceptibly increased the power of human vision. It permits, in fact, of obtaining the image of a star that would remain invisible with instruments of the same aperture as those that photography employs.—*La Nature.*

### Dialyzed Pitch.

The healing properties of vegetable resins are well known, and extracts therefrom in various forms are extensively employed in medicine; but they are more or less objectionable, as heretofore no means of removing or separating the foreign and hurtful substances have been used. Mr. Charles J. Ulrici, a chemist of Havana, Cuba, has succeeded in obtaining, by dialysis, a new and pure preparation, which is believed to be of importance for medical purposes.

The first operation is the filtration of the pitch to separate certain substances, which in its natural state are incorporated with it, such as vegetable remains, carbon dust, bits of leaves, earthy matters, deposits of smoke, and other impurities. These substances are separated and removed by the filter, while the heat applied drives out a portion of the bad or poisonous principles, which become volatilized by the heat.

Vegetable pitch may be said to be composed of two parts, one portion consisting of combined dense empyreumatic resinous matters of dark color; and, second, another of liquid nature, which holds in solution the first part. The acrid and nauseous odor of the raw pitch is due to the poisonous or hurtful substances, some of which are pyroligneous acid, formic acid, wood spirit, or methylic alcohol, aldehydes, acetones, methylic acetates, creosote, cyanides of ammonia, and benzines, and these substances, by means of bicarbonate of soda, become capable of being removed by the operation of dialysis.

The dialyzing apparatus is made with vegetable parchment in the usual manner. The dialyzer is placed within a suitable vessel containing distilled water upon a level table, care being taken that the level of the exterior liquid is the same as the level of the liquid contained within the parchment or dialyzer. The whole is allowed to stand three days, at the end of which time the exterior water is removed and a new quantity substituted. The first water is then tested with sulphuric acid, and note is taken whether there is any effervescence or discharge of carbonic acid. If there is, the dialyzation is continued for three days more, when the exterior liquid is again tested in the same manner described. If there is no effervescence, then the operation of dialyzation is complete, and the poisonous and injurious principles contained in the mixture will have been extracted therefrom and carried over to the exterior liquid, together with the sugar and the bicarbonate of soda, that which remains in the dialyzer being a neutral solution of colloidal and chemical nature derived from the useful principles or components of the pitch, the poisonous or hurtful principles or components having been removed.

The dialyzed pitch is then concentrated by the application of a gentle heat to evaporate it slowly. It is then mixed with coarse sand, and then evaporate from this mixture, with gentle heat, a portion of the water. The sand, after losing the water, will remain damp. Allow this to become cool, and then place it in a lixiviating apparatus.

This operation has for its object to dissolve the concentrated and dialyzed pitch that is imprisoned in the sand. This is accomplished by means of a suitable liquid vehicle, whereby the dialyzed pitch will be liberated from the sand and taken up by the liquid vehicle, and in this manner is constituted the extract of dialyzed or colloid pitch. The lixiviation is prepared for use with a liquid vehicle composed of alcohol and glycerine.

The operation of lixiviation makes a complete extract of the pitch which is imprisoned in the sand. Every portion of the liquid vehicle, when it comes in contact with the sand containing the pitch, becomes charged with a proportional quantity thereof, and each portion of the liquid vehicle takes up a portion of pitch until the whole has been completely dissolved and all the pitch contained in the sand joined to the water, alcohol, and glycerine, these three bodies being powerful and inoffensive solvents, and being the vehicle of which most fluid extracts are made.

This compound or fluid extract of dialyzed pitch thus prepared is of great medicinal value, as the hurtful substances have been removed. It is used for various medical purposes, such as the treatment of bronchitis, of throat diseases, of ulcers of all kinds, herpes, chronic rheumatism, scrofula, sores, and diseases of the skin.

### A RAILWAY SAFETY SWITCH.

The invention herewith illustrated shows a plan of constructing a switch by which a train moving on the main track will automatically close an open switch and bring the rails into alignment. To this end, sliding blocks are mounted to slide in inclined ways securely fastened to the ties in the center of the track beyond the ends of the switching rails. These sliding blocks have eyes at each end, to which are attached chains, one communicating with a rod connecting with the sliding block at the other end of the switching rails, and

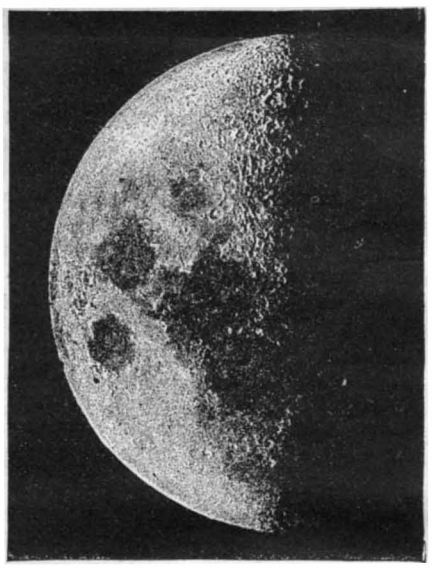
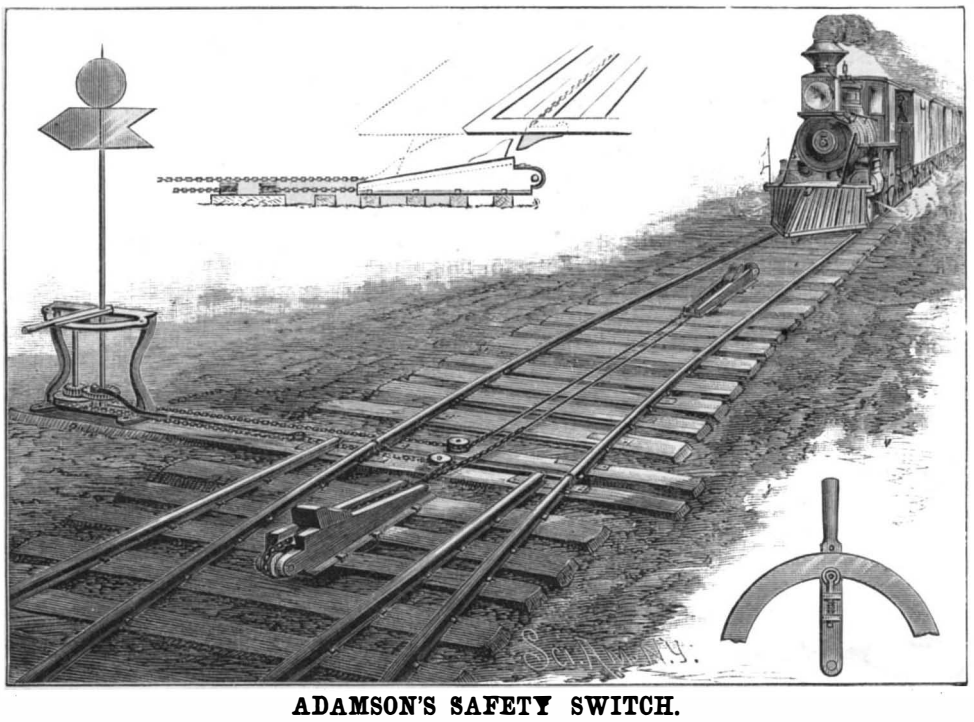


Fig. 1.—PHOTOGRAPH OF THE MOON.

the other passing around a sheave in the inclined way, then around another sheave in the center of the track, to and around a chain wheel mounted in the switch stand. A dog or catch is pivotally connected to the under side of the locomotive, and when the train approaches a switch set for a siding, as shown in the engraving, this dog strikes the sliding block, moving it in the manner indicated by the dotted lines in the small view, drawing the chain to revolve the chain wheel in the switch stand, and thus moving the switch bar to bring the switching rails in conjunction with the main rails. The switch lever rides above a circular rack which projects from one side of the switch stand, and has a yielding roller catch. The various parts are so arranged that when the main line is open the sliding blocks will be at the lower ends of their inclined ways, so they will not then engage with the dog on the lower side of the pilot; but if the train is to be switched, the dog is raised by a simply arranged device, so as not to throw the switch to the main line. With some slight changes in details, which are set forth in the patent, this form of switch is also adapted for use where there is a switch or siding on each side of the main track.



ADAMSON'S SAFETY SWITCH.

This invention has been patented by Mr. Robert Adamson, of Auburn, N. Y.

### Monument to Friedrich Wohler.

The great German chemist Friedrich Wohler died in 1882. In recognition of his eminent services, the German Chemical Society at once proposed the erection of a monument at Gottingen, where most of his life's work was accomplished. A sum of $4,000 has been collected, but as this is not sufficient for the purpose, an appeal has been made to American chemists to aid in honoring one who has done so much to elevate their calling to the rank of a true science. The American committee particularly appeals to those who formerly studied under Wohler, and to all who are interested in the science to which he devoted his life. Contributions may be sent to Prof. Ira Remsen, Johns Hopkins University, Baltimore, Md.

THE following is given as a cheap mode of rendering fabrics uninflammable: Four parts of borax and three parts sulphate of magnesia are shaken up together just before being required. The mixture is then dissolved in from 20 to 30 parts of warm water. Into the resulting solution the articles to be protected from fire are immersed, and when they are thoroughly soaked, they are wrung out and dried, preferably in the open air.—*New York Times.*

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## The Price of Life.

BY EDWARD ATKINSON.

We have become so much accustomed to measure the price of things in money that it is a little difficult to forget the rates of wages, earnings, or profits, and look only at the actual results of toil. But reflection will show that that for which men and women really work is not money, but subsistence. The price paid for shelter, food, and clothing is the price of sustaining life. It is therefore an urgent problem for millions how to get a good subsistence for less money than they now spend for a poor one. The way for the working classes to improve their condition is to produce more or waste less. When each one has found out this secret for himself, the labor question will be practically settled. All there is in it is how to answer the all-absorbing question, "What is the price of life?"

The magnitude of this problem to the people of the United States appears from the fact that 90 per cent of them trust to their daily work for the daily price of their own lives and of those who depend upon them. In the "working classes," in the narrow sense of that term, are reckoned laborers, servants, mechanics, and factory operatives. with whom may be included teachers, clerks, salesmen, saleswomen, seamstresses, and the like. In the strictly working class may also be included 90 per cent of all the farmers who own their own land, but who work harder than any of their hired men. To all such persons the price of life is the one question which is ever before them.

There is a somewhat subtile distinction between the cost of life and the price of life. The cost is the force consumed. In respect to each individual, it is the effort which he makes, be it great or small. The true cost of life is the measure of the actual work performed by each person in order to secure the shelter, food, and clothing which are necessary, together with the additional comforts and luxuries which each person can afford to enjoy, including leisure. By "leisure" is meant the control of a part of each day free from the urgent necessity of working for mere subsistence. It may be that he who attains such leisure will adopt the definition of this word which is given by the "old Bohemian" in his cookery book. He says that "leisure consists in the diligent and intelligent use of time."

In contrast with this broad view, the cost of a man's life to the community, whether he be capitalist or laborer, is just what he consumes out of the annual product, and no more. The price of a man's life to himself is what he pays out of his earnings for his necessary consumption. A man can live at a very low price to-day, and if he be intelligent, he may earn the price at the cost of very little labor.

To measure the price of life, let us suppose that a single man in the city of Boston puts the question to himself, "At what price can I live independently by myself in a small room, or chumming with a companion in a better room?" The answer is that $200 a year is the price of a very comfortable subsistence. If he can earn $200 for eight or six hours a day's work, he will also live at a low cost and enjoy a large modicum of leisure.

If the man is really poor, or if he desires to save a large part of his earnings, the price of his life in money may even be reduced to $150 a year. But he must be a very intelligent man who can live comfortably on that sum. He must be rather more capable than the average man. It takes a great deal of intelligence to get the most comfort for the least cost. How is it to be done?

1. Shelter. Two young men can find a decent room in one of several parts of Boston, tolerably furnished, which can be hired for $100 a year, or $50 for each, including the care of the room and the modicum of heat which they will need in winter. If they choose to take care of their own rooms and to buy their own fuel, they can do still better.

2. Clothing. If the man knows where to buy and what to buy, he can purchase a full and comfortable supply of clothing, including outer and under garments, hats, boots, and shoes, overalls and the like, at a cost of $45; that is to say, within this sum may be included one-third part of the wear of a best overcoat, of a best pair of shoes, and of a best suit of clothes for Sundays and holidays; also a good, warm woolen suit for every day wear, at a cost of $8.50, to be used up in the year, and all other necessary articles of good quality. If the man cannot afford $45 per year, he may dispense with a best overcoat; and if he be willing to wear very durable satinet garments in winter, he can save from $5 to $8 on the $45. A very warm and durable suit of satinet can be purchased for $5.50. None of these garments will be of the so-called "slop-shop" order, made at starvation wages by poor sewing women. The fabrics will have paid a profit to the mill owner; the making of the garments will have been profitable to the clothier; the cutters will have earned $15 to $20 per week, and the shirt makers $10 to $12 per week. And the sewing of the woolen garments will have been done in the farm houses of New England, bringing to the wives and daughters of the household a little money income where it is most needed.

3. Food. A very economical kind of life is thus far simple and easy. The difficulty arises the moment we touch the question of food. To the working classes—again using this phrase in its narrowest sense—one-half the price of life consists in the price paid for food.

From the best information which can be obtained, the price of an adequate supply of food served in the ordinary way, either in boarding houses or in workmen's families, is from 20 cents to 30 cents a day for the mere cost of the materials. How much is wasted in bad cooking after the materials are bought, each reader can imagine for himself. The average cost of the materials in the cities of the East is not far from 25 cents per day. On a larger scale, the inmates of the jails of Massachusetts are supplied with food in a perfectly nutritious and suitable manner, the food being of excellent quality, at a cost for materials of from 13 cents to 15 cents a day.

Probably no single man or woman in Boston or New York could obtain at any restaurant, or at any cheap boarding house, a suitable supply of nourishing food, well cooked, at a cost of less than 30 cents or 35 cents, probably more. In some of the factory towns, like Lowell, mill operatives who have their rooms elsewhere, but who get their meals in the factory boarding houses, are served with good, nutritious meals, three times a day, at $1.60 to $2.50 a week, or from 28 cents to 35 cents per day. But in these cases the houses in which the meals are served belong to the factory corporations, and yield little or no rent.

It would therefore seem to be difficult for a single man, after having expended $120, viz., for rent $50, clothing $45, washing $15, and heating say $10, to obtain an adequate supply of food without coming to the ordinary rule of spending as much for food as for all the rest of his subsistence, or at least $120 to $150. But yet even this supply involves a very great waste if the daily ration be considered in respect to the absolute nutrition required.

The science of nutrition is now being investigated in the most thorough manner, especially in Germany, where the utmost economy has become necessary in order that there may be food enough to go around. What are some of the results? Assuming that the average expenditure of working people is 25 cents a day for food material for each adult, it can be conclusively proved that a sufficient and appetizing daily bill of fare can be served at one-half this cost in Boston to any one who knows what to buy, how to buy it, and how to cook it. This method would imply to a large extent the substitution of the stew pan for the frying pan, of oatmeal, farina, and the like for pale pie and doughnuts, and of good, well-made bread, like that which is sold in New York by the Howe National Bakery at 3 cents a pound, for dyspeptic biscuit served hot.

The trimmings of the best joints of meat are now thrown into a scrap heap, and sold in every market at from ¼ cent to 1 cent a pound, to be rendered into fat. I am assured by a market man in our principal market here that enough good meat is wasted every day from that market to feed 1,000 people or more. Of course, when people become intelligent enough to make a selection from this food which is now wasted, the price may rise in some measure. But when that which is now wasted is substituted for sirloin and rump steak, the price of the best cuts may be reduced. This is the reason why the best cuts even of American beef are cheaper in London as compared with the prices in New York and Boston. The English know how to make use of the coarse parts of beef and mutton much better than we do. The average of the whole beast is higher in price in England than it is here. We pay the highest price for what we call the best part, and we waste the rest, or else it is sold at a small price to the keepers of the jails, to be served to persons in a form which makes it better food than three-quarters of the workingmen outside the jails can secure for a much higher cost. I have myself purchased this good meat, which is now wasted, at 1 cent a pound, in parcels of ten pounds, at which price the market man said he would select any quantity at any time. Adding to this ten pints of water, with suitable seasoning, I have made a rich and nutritious bouillon. Rejecting the bone and leaving the stewed meat in the broth, ten pounds remained of very nutritious and appetizing food, at a cost not exceeding 12½ cents for the ten pounds of food, including the fuel with which it was prepared. It was cooked in an airtight vessel surrounded by hot water. In the same vessel—a pine box—in which this bouillon was prepared there were cooked at the same time seven pounds of solid beef in another vessel and two pints of oatmeal in four pints of water, making in all about twenty-five pounds of food material thoroughly cooked with 1 cent's worth of kerosene oil burned in a hand lamp.

In a smaller vessel of the same kind, three pounds of solid meat can be thoroughly cooked in its own juice in one hour and a quarter, with ¼ cent's worth of oil burned in a common lamp, which may also serve the purpose of lighting the room while the cooking is going on.

The singular merit of this apparatus is that a very ample supply of food for a large family may be put into the various receptacles at night, the lamp may then be lighted, and in the morning everything will be ready to be served. In this method no overcooked food is possible. After the chemical changes caused by heat are accomplished, the further effect of the application of heat is merely to keep the food hot, or to render it more tender if it be tough meat. The walls of the vessel being non-conducting, the food will keep hot for many hours after the lamp is extinguished.

If this apparatus proves as useful in common practice as it appears to be in what I may call my cooking laboratory, a difficult question may perhaps have been solved. Given this or some other cheap application of fuel to the conversion of food, and it is entirely possible to buy an ample and nutritious ration, in considerable variety, in the city of Boston, at not exceeding 7 cents a day, and to prepare it for use within 8 cents a day.

At 14 cents a day, a day's ration may cost, in round figures, $1 a week, or $52 a year, and consist of one-half to three-quarters of a pound of good meat, three-quarters to one pound of bread, one-half to one pound of potatoes or some other vegetable, one-half pound of oatmeal, one-half ounce of butter, one ounce of sugar, a large bowl of tea or coffee with a spoonful of condensed milk, an orange, an apple, or some dried fruit.

Add 1 cent's worth of kerosene oil for cooking, all but the bread, which must be baked elsewhere, and we have food and fuel for cooking it at $1 a week. This economy is possible in what may be called laboratory practice. How long will it take to make it common practice? How long will it take to alter the taste of the people from fried food and hot biscuit to stewed food and sound bread? If this can be done, as it now seems possible, the price of a well-conditioned life in the city of Boston for food, shelter, clothing, fuel, and laundry may be covered by the sum of $172, leaving within the limit of $200 a year $28 for sundries or luxuries.

Either in this way or by way of combinations on a more moderate scale, like the "commons" table at Harvard College, at a less price, the price of life may be brought within a very small sum. The waste of food appears to require more attention than any other economic question that is presented to us at the present time, and, as was suggested at the outset, the true labor reform movement might well consist in teaching the workman how to help himself to get a good subsistence for less money than he now spends for a poor one. The price of food is half the price of life, and half the price of food is wasted for want of knowledge how to buy it and how to cook it. Five cents a day saved per capita would come to over $1,000,000,000 a year. Do we waste a thousand million dollars' worth a year or not? This problem was better comprehended by our Puritan ancestors than by their descendants or by our adopted citizens. How to get a good living out of small resources has become almost a lost art.—*Bradstreet's.*

## Carbonic Acid and Steam Reaction.

In a paper by A. Naumann and C. Pistor on "The Reaction between Carbonic Oxide and Steam"—*Journal of the Chemical Society*—experiments are described, made with a view of ascertaining the temperature at which carbonic oxide and steam react to form carbonic anhydride and hydrogen. The method consisted in passing carbonic oxide, freed from carbonic anhydride and oxygen, over water heated at 80 degrees, so as to obtain an approximately equimolecular proportion of carbonic oxide and vapor of water. The mixed gases were passed through a porcelain tube, the temperature of which was roughly determined by introducing into it certain salts or spirals of various metals; the resultant gas was then analyzed by the usual methods. The following results were obtained: At 560 deg. no reaction took place, at 600 deg. 2 per cent, at 900 deg. 8 per cent, and at 904 deg. 10·5 per cent of the carbonic oxide was converted into carbonic anhydride. All the conditions which militate against a reaction between carbonic anhydride and hydrogen are favorable to that between steam and carbonic oxide, inasmuch as such a change would be exothermic— +10,720 cal.— and the resultant carbonic anhydride is very stable at high temperatures, while the steam is readily decomposed into hydrogen and oxygen, the latter of which can burn the carbonic oxide.

## Frosting Brass Work.

Boil in caustic potash, rinse in clean water, and dip in nitric acid till all oxide is removed; then wash quickly, dry in boxwood sawdust, and lacquer while warm. This will give brass an ornamental finish.

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### Bacteriotherapy.

"Bacteriotherapy" is the designation appropriated for a new method of treatment introduced by Professor Cantani, based upon the recognized phenomenon of the "crowding out" of one species of microorganisms by another better suited to the prevailing conditions (*Brit. Med. Jour.*, Aug. 29, p. 403). In a first experiment, daily inhalations of *Bacterium termo*, an organism assumed to be harmless, on the strength of experiments on animals, were administered to a patient suffering from tuberculosis, through the medium of a culture in gelatine diluted with meat broth and diffused by an ordinary spray producer. Professor Cantani reports that the tubercle bacilli in the sputum gradually became fewer, being replaced by the bacteria, and in less than a month had disappeared altogether, the sputum being no longer capable of conveying tuberculosis to animals. Meanwhile the patient had gained flesh and improved in every way. It is admitted that, outside the body, these bacteria do not always so successfully dispose of the tubercle bacilli, and that the two kinds of organisms even sometimes occur together in tubercular cavities; but the explanation suggested is that in the case reported the bacteria were introduced in large quantities and probably in a vehicle more favorable to them than to the bacilli. Does this foreshadow a recrudescence of contributions to the official materia medica from the animal kingdom?—*Pharmaceut. Journal.*

### The Palace at Jeypore.

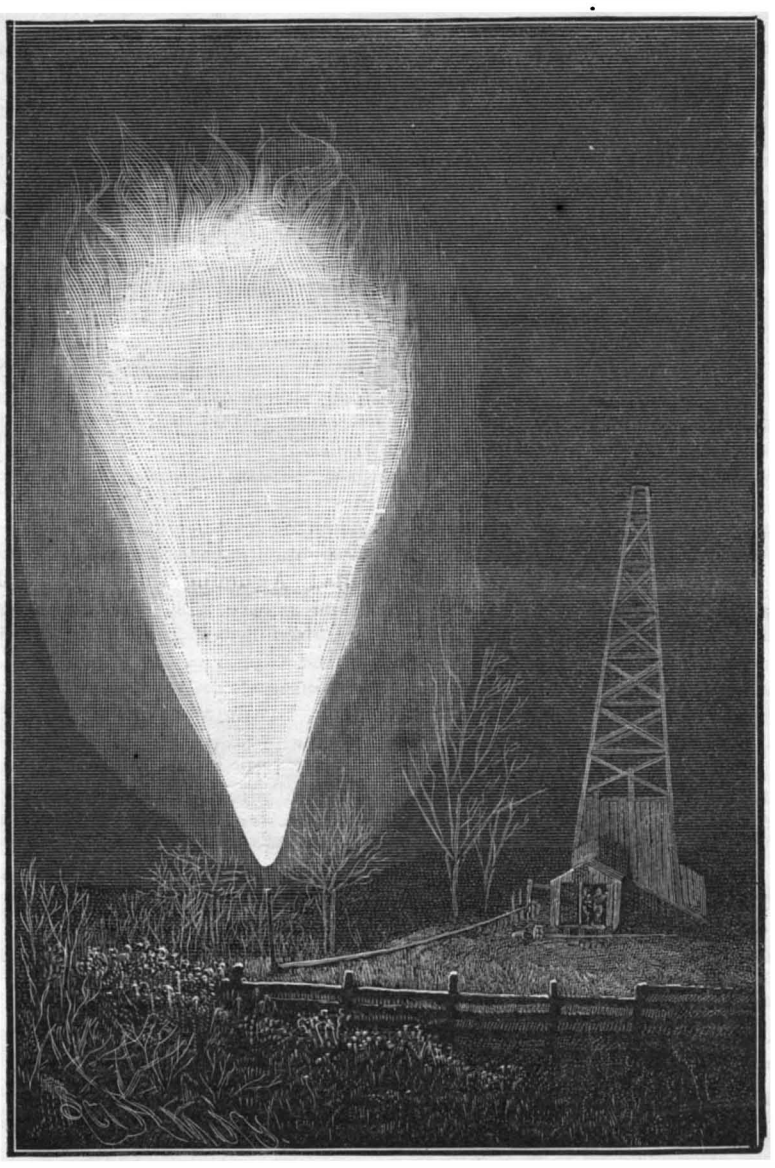
Mr. Sala has had the good fortune to visit the Great Palace of Jeypore, and writes about it thus in the London *Telegraph:* Seven stories of such wild and lovely structure as you would expect to see only in dreams rise here one above the other in rose red and snowy white balconies, oriels, arches, pilasters, lattices, and domes—gay everywhere with frescoes and floral ornaments. In this lowest floor, which is kept —like the second and third—as a winter residence, we are permitted to inspect a priceless volume, the abstract of the Mahabharata, in Persian, made by the orders of Akbar the Great at a cost of £40,000, and illustrated in the most exquisite manner with colored and gilded miniature pictures of an incredible delicacy. The Shobha Newas, floor above, is full of strange paintings on the wall, and arcades embellished with gorgeous shells of copper, silver, and foil. Next we ascend to the Cnhabl Newas, or "hall of splendor," shining with polished marbles and colored enameling. Above this is the Shish Mahal, the pavilion of glass, with endless patterns wrought in little mirrors let into carved plaster work, and above that we step forth upon the Mokt, or "crown," of the palace, where the vast flat roof is encircled with shady alcoves and open chambers, vaulted by graceful curved cupolas. Beneath lie the green palace gardens, full of pomegranates, palms, and bananas; and beyond, the spread of the countless busy streets and lanes, girdled by the walls, and overhung by the encircling hills, topped with forts and temples. It is vain to attempt any description of that enchanting prospect, more absorbing than any which India herself can offer. Nature and man have here allied themselves to produce the most perfect and lovely landscape conceivable. In green and gold, in rose color and white, in distant, dim blues and grays, the gardens and the city, and the far off walls and mountain ridges of amber, group together at our feet—a picture to delight the eye and feast the mind. But how can words reproduce Govinda's temple, between the upper and lower gardens; the snow white sides of the Badal Mahal, or "Cloud Palace," on the edge of the lake; the dark ramparts of the fortress in the mountains, and those long lines of rose red streets which intersect Jeypore? To complete the rich colors of the scene, a feast is being given to Brahman men and women on one of the many flat roofs of the upper palace, and attendants go about bearing the Maharajah's bounty in the form of cakes and sweetmeats amid some three or four hundred men and women clad in holiday dresses of crimson and purple, saffron and blue, glittering like flowers in the sun, which shines upon the "City of Victory" as if its people were indeed his children. Whoever has viewed that prospect from the palace roof of Jeypore has seen India in her inmost grace and beauty.

### The Zinc Architectural Works.

On the night of March 5 the entire stamping department of the Zinc Architectural Ornament Works of Messrs. Bakewell & Mullins, at Salem, Ohio, was destroyed by fire. The plant will be replaced at once, and orders filled as promptly as circumstances permit.

### Soda Lakes in Wyoming.

A newspaper published at Laramie with the significant title of the *Boomerang*, referring to a recent article in the SCIENTIFIC AMERICAN on the manufacture of soda at Owen's Lake, Cal., says that if the right kind of men, with plenty of energy and abundant means, were to take hold of the business in Wyoming Territory, they would find their reward. The writer affirms that in this Territory, Nature has done all that she could to save man trouble. Here there is no necessity for portable engines or for vats. It is not necessary to wait a year in order to gather a crop of soda. Not only have we a cluster of lakes of the solid stuff within two hours' drive of Laramie, and with a railroad running directly to their banks from this city, but similar lakes are found in various parts of Wyoming. No pumping or settling is required, the soda gathers itself and solidifies like ice. All that is necessary is to dig it out with a pick and shovel, haul it to the chemical works in this city, and work it up. The soda plant at Laramie has been greatly enlarged and improved during the past winter, and will now have a capacity one-third greater than it was originally designed for, yet it will not handle one-third of the yield of lakes on the Laramie plains. Thus far only one of these lakes has been drained and worked. There are two larger lakes, either one of which would keep a plant as large as that in Laramie going the year round, and in all the supply is inexhaustible, the deposits being constantly built up from some underground basin; but these lakes are not so extensive as others in the Territory which have not as yet been touched.



THE KARG NATURAL GAS WELL AT FINDLAY, O.

### Natural Gas at Narrowsburg.

The existence of natural gas at Narrowsburg was discovered in a curious way by Dr. L. A. Winslow, in 1856. He was spending the summer at the Murray House, in that village. The Delaware River at that place forms into a deep and wide lake-like body known as Big Eddy. On the Pennsylvania side of the eddy there is a whirlpool so strong that frequently rafts are drawn into it and kept whirling about for hours and sometimes days before they can be turned into the channel again. One day Dr. Winslow was rowing on the eddy. After lighting his pipe he threw the match, still blazing, into the river. Instantly a blaze started up in the water where the match had dropped. It burned with a faint blue light, and finally went out. Then, for the first time, Dr. Winslow noticed that many bubbles were floating about on the water, and that they appeared frequently, coming quickly up from under the surface. The Doctor, being something of a geologist and scientist, knew at once that the bubbles were made by a gas that must come from the ground or rocks at the bottom of the river, and that the gas was inflammable. He touched a match to several of the bubbles, and each one responded with a blaze. At night he illuminated the entire eddy with these miniature natural bonfires. Dr. Winslow sounded the eddy, and found that in places the water was ninety feet deep, with a rocky bottom, and at some places he could find no bottom at all. His theory was that the rocky bottom was filled with crevices of unknown depth, and from them gas issued and found its way to the surface, forming the constantly appearing and disappearing bubbles.

In the mud along the shores of the eddy, and on islands of similar formation, this gas also found its way from the depths to the surface. Dr. Winslow inverted a barrel with one head out over a spot on the New York shore where the gas came up out of the ground. He placed a small pipe in the other end of the barrel, and in a short time collected enough gas in the barrel to make a strong and brilliant flame at the end of the pipe when ignited, which burned steadily night and day.

### A NATURAL GAS WELL.

The accompanying engraving is from a photograph of the mammoth Karg well at Findlay, Ohio. The photograph was taken by night, and the enormous height reached by the flame may be judged by contrast with the derrick in the background. The capacity of the well is estimated at forty million cubic feet per diem.

### Taking Down an Iron Mast.

An interesting and very difficult mechanical feat was performed in Akron recently, in the taking down of an iron electric light mast 213 feet in height above ground. The mast was composed of fifty-five sections of boiler plate, each fifty inches in length and varying in thickness from one-half inch at the base to three-eighths inch, five-sixteenths inch, one-fourth inch, and at the top three-sixteenths inch. The diameter at the base was three feet, and at the top eight inches. The entire weight of the plate removed was eight tons. A change in the system of street lighting led to the abandonment of the mast, and the contract for taking it down and removing it was given to the Buckeye Machine Company, of Cleveland, whose efficient general manager and engineer, Mr. Ludwig Herman, had charge of the work. From the outset—the mast itself being bent out of plumb and in a dangerous condition—the task presented numerous and trying difficulties, but careful calculation, coupled with cool-headedness and superior engineering skill, were adequate to successfully grapple them all. The method of removal, briefly, was this: Around the lower sections of the mast, to a height of twenty feet, a staging was erected. This was composed of uprights 8″×8″, caps 10″×10″, sills 8″×8″, braces 2″×10,″ and struts 6″×6,″ all securely bolted together. From this staging, by means of chain blocks and swivel rods and peculiarly shaped hooks which took hold under the lap of the successive sections, the mass was suspended while the work of cutting the rivets and removing the sections was carried forward. The hooks in question were held in place by an adjustable band three inches in diameter. After cutting away the lower sections, the whole mast was lowered four inches at a time, the hooks shifted to the lap above, and the lower section cut out again. In this way the work proceeded, the mast being held by ten guys, the manipulation of which required the utmost skill and patience. At one time, during an adverse wind, the top of the mast swayed fifteen inches out of line, but close watching and careful management averted all accidents, and the entire task was successfully completed in a remarkably short period of time. For the first three days one section each day was removed; then three, five, and twelve, and on the last day, twenty-seven.—*Iron Trade Review.*

### Petroleum in New Mexico.

The report that an artesian flow of petroleum had been discovered in the southern part of Santa Fe County, New Mexico, between the mining villages of Golden and Wallace, has been confirmed, and samples taken to the capital and tested. The oil flows through tubing fifty-five feet down, and the flow is reported to be copious and steady. The crude oil burns freely and with a good flame. Several claims have already been located in the neighborhood of the well.

### To Remove Nitrate of Silver Stains.

The following is suggested by Mr. George R. Underwood: Dip the fingers into a strong solution of cupric chloride. In about a minute the silver will be converted into chloride, and may then be washed off with hypo.

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## ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. Joseph T. Hammick, of Rhinebeck, N. Y. It has stationary and movable drawheads, hinged lifting block and bail, with other novel features, whereby the coupling link is permanently connected with the draw-bar, etc., the invention being an improvement on a former patented invention of the same inventor.

A switch lock and throw bar has been patented by Mr. William B. S. Reed, of Brooklyn, N. Y. This invention covers a novel construction and arrangement of parts for an improved device for throwing switches, which at the same time serves as a lock for automatically locking the switch in place, both when open and when closed.

A station indicator has been patented by Mr. Watson Fuller, of Atlanta, Ga. The invention consists in combining with a shaft a series of rollers or drums surrounded by boxes, each pair of drums carrying a band on which are the names to be shown, and the whole operated by a mechanism to indicate successive stations in their proper order at different parts of a car at the same time.

A locomotive whistle alarm has been patented by Mr. Charles Hults, of Torch Lake, Mich. It is a novel construction, by which a whistle can be operated automatically by inclined guides at the sides of the track, whereby a whistle signal is given automatically by the locomotive before the train reaches a crossing, bridge, or other place where a whistle is to be regularly sounded.

## AGRICULTURAL INVENTIONS.

A wheel plow has been patented by Mr. Moses B. Farnham, of Germantown, Cal. The construction is such that when the forward end of the tongue is secured to the neck yoke of the team, the forward end of the machine will be moved to one or the other side, to cause the plows to take or leave land, the object of the invention being to facilitate the replowing of summer fallowed land.

A check rowing attachment has been patented by Mr. Edward F. Crawford, of Honey Bend, Ill. Combined with a frame and seed slide is a rotary shaft for operating the slide and carrying the wire wheel, with devices whereby the position of the rotary shaft and its wire wheel may be changed, to be operated from either side of the machine, making a simple attachment to facilitate the planting of corn in accurate check row.

## MISCELLANEOUS INVENTIONS.

An attachment for tape measures has been patented by Mr. Edward Herline, Jr., of Hoboken, N. J. The invention consists in a link and hinged point for securing the end of the tape in place, and thus facilitate convenience in the use of such measures.

A mouse trap has been patented by Mr. Lester H. Gear, of Mentor, Iowa. It consists of a cage with tilting plates hung in an opening, with stepped outer ends, and a bait suspending hook upon inclined plates of the cage over the covered openings, by means of which any number of mice may be caught without resetting the trap.

A foot rest for school desks has been patented by Mr. William P. Connor, of Bloomsburg, Pa. Combined with the desk are curved notched bars on the legs and a swinging foot rest bar above the notched bars, with winged nuts for locking the foot rest bar in place, so the rest can be adjusted in different positions or swung entirely out of the way.

A grinding mill has been patented by Mr. Lewis B. Joy, of Bath, N. Y. It has rollers with corrugated faces and grinding plates with beveled and corrugated inner edges, with other novel features, to facilitate the grinding of mixed grains for feed, but making a mill which can also be used for grinding grain for other purposes, and which is so constructed that it can be readily adjusted and controlled.

A combined dust pan and ash sifter has been patented by Mr. John O. Beneke, of New Orleans, La. It consists of lower and upper pans or sections, made of tin or other suitable material, the bottoms being of circular form, and having perforations of any desired pattern, but so arranged that the perforations of the upper and lower pans may be brought in line to pass matter through or not, as desired.

A churn has been patented by Mr. Jas. Hultz, of Greeley, Kan. It is so made that by the turning of a crank, when the churn body is charged with milk, the dashers will be rotated in opposite directions until the butter comes, when they can be made to rotate in the same direction to gather and wash the butter, both dashers being easily removable from the churn when desired.

A drag saw has been patented by Messrs. Ira B. Warren and Charles M. Potter, of Waucoma, Iowa. It is a power machine, in which the beam or log of wood to be sawed is placed in a trough secured on bars pivoted on the base frame, and then the log is pressed toward a saw blade operated by suitable mechanism until the operation is completed, when the frame is swung back from the saw.

A roller skate has been patented by Mr. Joel Heacock, of Brighton, Iowa. It is made with a main roller just forward of the heel, and intended to be almost directly beneath the center of gravity of the body, while there is a forward roller under the ball or toe, on either side of which are guide rollers, the skate being for use on a single track of a railway, the skater propelling himself by means of a staff.

A horse marsh-shoe has been patented by Mr. Charles Dumke, of Portland, Wis. It consists of a board provided at opposite edges with bars and oblong holes, in combination with eyebolts with heads and a lever fastener for clamping the board to the horse's hoof, making an extended surface for the horse's shoe, to prevent the horse from sinking into the ground in marshy places.

A combined step ladder and adjustable platform has been patented by Mr. Stephen J. Palmer, of Dover, N. J. The construction consists of a platform mounted on end strips carrying steps, and so arranged that it may be set up at different heights, making a useful and safe device for women to work upon about the house, and one which, when folded, takes up but little room.

A gun barrel has been patented by Mr. John K. Ballard, of Grayling, Mich. A short distance in front of its breech end the barrel has an annular groove in its bore, the groove increasing in diameter from the muzzle end toward the rear, whereby the annular shoulder is formed in the barrel, so that cloth patched cartridges can be fired without causing the patch to catch in the barrel.

A steamer for use in the ovens of stoves and ranges has been patented by Mr. Charles F. Hanneman, of Ahnapee, Wis. It is of such construction that it may be supported on the ribs or guides usually provided in the upper portions of ovens, or otherwise conveniently placed without interfering with the ordinary uses of the oven, so that articles being baked may be partially steamed or moistened while in the oven.

A grain register has been patented by Mr. Lloyd Nottingham, of Norfolk, Va. Combined with a body or case, and a wheel having a lateral annular flange with a notch or gap, is a second wheel journaled within the flange, with a support and two pawls pivoted thereto, located laterally thereto, with other novel features, making a simple device to indicate on a dial the number of counts of certain measures of grain.

A case for photographic sensitized paper has been patented by Messrs. William H. Lewis and Erastus B. Baker, of New York city. It is a box that is light tight when the sensitized sheet is wholly within the box, or being moved in or out of the box, and adapted for carrying a roller, to be operated from the exterior of the box, for supplying sensitized paper as desired, whether to be used for making negatives or for photographic printing.

Aerial navigation forms the subject of a patent issued to Mr. Ringert Jongewaard, of Harrison, Dakota Ter. This invention covers a construction designed to rise upon the wind by presenting the under side of an inclined plane thereto, while propelling the machine slowly toward it, or to rise on still air, propelling the machine more rapidly in the desired direction, the propeller being driven by the strength of the rider.

A button has been patented by Mr. Gabe Felsenthal, of Louisville, Ky. It has two pairs of spring arms projecting from its back, with two angled levers pivoted in the extremities of the arms, having angled shoulders, which engage each other when the button is arranged for insertion in the button hole, and when it is in position to be worn, making an easily inserted collar or cuff button that will not tear the button hole.

A mould for casting solder joints has been patented by Mr. Arthur Cunningham, of Louisville, Ky. It is made in two halves, arranged to register as they are closed around the pipe, and will hold sufficient melted solder to form a joint of the required size and shape, thus forming a joint by casting upon either a horizontal or vertical pipe, the mould being a device which can be used by inexperienced workmen to make a perfect joint.

An automatic safety check for musical boxes has been patented by Mr. Charles H. Jacot, of Hoboken, N. J. Combined with the cylinder shaft is a friction wheel and a balanced friction pawl, whereby the shaft will be stopped and held should its speed be unduly increased by escaping from the control of the escapements by accident or during adjustments, thus exposing the cylinder pins and the teeth to danger of breaking or injury.

An escapement lever for watches has been patented by Mr. William B. Simpson, of Holden, Mo. It is so made that the lever fork of the escapement can be readily adjusted forward or backward relatively to the ruby pin of the roller plate of the movement, without taking the watch apart and while the balance wheel is on, so that a person can make the necessary adjustment while the timepiece is in working order.

A device for filing saws and drilling has been patented by Mr. Charles L. Polley, of Sandusky, Ohio. It consists of a suitable frame with handles, bevel wheel, detachable file, and socket shaft, which may be used as a means of attaching a driving rope or to receive any tool, such as a drill or an auger, to be driven either by power or hand, or an emery wheel with suitable gear attached may be substituted for the rotary file and wheel.

A saw gummer has been patented by Messrs. Albert Stevenson and John Stuempges, of Stevenson's Pier, Wis. Combined with a base block and clamping plate are dies held therein, yokes on the sides of the base block and screws in the yokes, for adjusting the dies on the base block, the tool being adaptable for clamping any thickness between the base and the top plate, and the invention being an improvement on a former patented invention of one of the inventors.

## NEW BOOKS AND PUBLICATIONS.

"OUTING" for April, under its new management, fully maintains its hitherto well established character. Its matter is all choice in character, while the illustrations and typography are most admirable. Among the principal articles in this number are Ranch Life, by Theodore Roosevelt; American Steam Yachting, by E. S. Jaffray; Around the World on a Bicycle, by Thomas Stevens; Crossing the Atlantic on a Blockade, by Captain Roland F. Coffin; and Work and Sport on the Congo, by Henry M. Stanley—but this by no means exhausts the list of attractions presented.

## Special.

### THE UNITED STATES MAIL.

On the end of a business house on Market Street, Philadelphia, adjoining the new United States Post Office, there is an exceedingly suggestive picture, in two panels, giving the old and the new ways of delivering the United States mail.

The one indicates a very little to do, with leisure in which to do it. The other, much to do, for which haste is required. To one who is familiar with the growth of the postal service, this picture starts a very interesting train of thoughts. One of these brings back the old stage-coach and the horseback rider, and the fact that between these two the work of distributing the mails of the country was divided. Over against these come to mind the facilities of the present day, with the high rate of postage reduced to figures hardly more than nominal by comparison. From the external mechanical changes the mind turns to the contents of the letters, both of the old time and the new.

One of the most engrossing topics in which people everywhere always have had, and always will have, a common interest is the matter of personal health.

A large class of writers, seeing in the public press the statement of cures by the Compound Oxygen Treatment, which has been so widely advertised, at once write to the references for fuller particulars. The patients who have been cured are so numerous, and they have so freely spoken of their restored health, that the divided task has been to many a light one. But one lady in Maine writes us that she has answered letters from nearly every State, and from some sections very many.

Hon. William D. Kelley, Member of Congress, answers a very large number, saying that he owes the good health he has enjoyed for ten years to the treatment. Hon. William Penn Nixon, editor of the Chicago *Inter-Ocean*, receives hundreds of inquiries as to the genuineness of his testimonials and as to the permanence of results. These he answers through the mail, as it was through a letter received from a relative in Boston that he learned first of the value of the remedy. Once in a while one too hard pressed finds it necessary to ask relief from part of the task, as in the case of a prominent member of the bar of Topeka, Kansas, Hon. H. P. Vrooman, whose title came through service in the courts for a term as judge. He is also prominent in temperance work, being Chairman of the State Executive Committee of the Prohibition Party of Kansas. In one of his letters he says, "I have been interrupted about twenty times since commencing writing." This brief statement gives some idea of the value of his time. The reason for his being called upon on this subject, and letters written to him, is found in a letter to Doctors Starkey & Palen, June 27, 1882, telling of the benefits his wife had received from their Compound Oxygen Treatment. We quote exactly: "In the interest of suffering humanity I send you for publication an account of the *almost miraculous cure* which your Compound Oxygen performed in the case of my wife. Her condition was a very peculiar one. She had a complication of diseases—dyspepsia, torpid liver, or liver complaint, as her physicians have always called it, and general nervous prostration.

"If you will refer to my description of her case, when I made the first order for your Treatment, in December, 1877, you will see that she was suffering from severe attacks of colic and vomiting. These attacks first came once in two or three months, when she would vomit herself almost to death's door, and until she would raise a large amount of green bile. When her stomach was relieved from this, she would become better at once. But as soon as a certain amount of bile would again accumulate, there would be another attack of colic and vomiting. Each time the attacks came at shorter intervals, and were more severe, until she became so weak and exhausted that *we are sure she could not have lived many days longer, had not your Oxygen Treatment come just as it did and saved her*, for the colic and vomiting had become almost perpetual, *and her strength and life were nearly exhausted.*

"*We could see a change in her condition from the first inhalation*, for she never had so severe an attack of colic afterward, and had more strength to endure the pain and retching. She continued to gain steadily, and for the past four years has had no severe attacks. If she is threatened with one, she takes an inhalation or two, and so escapes any severe paroxysms.

"We have used in all nearly five Home Treatments in four years. One of our boys, fourteen years of age, had an attack of inflammation of the bowels, which left him in a very bad condition. The Treatment did him nearly, if not quite, as much good as it did Mrs. Vrooman.

"I think it but right that we should make known to others what Compound Oxygen has done for us, and therefore send you this statement for publication."

Such a statement of necessity attracted wide attention, especially among invalids, who naturally wanted particulars. These Judge Vrooman has in all cases cheerfully given, so far as his time would permit. This he has continued to do for nearly four years, to the gratification of all who need such aid. At the same time his business engagements have made it desirable that a portion of the time thus occupied might be saved. This wish he expresses in a letter, dated February 24, 1886. It is as follows:

"Since I sent you my testimonial, which you published in June, 1882, I have received scores of letters from all parts of the United States asking almost all kinds of questions about the Oxygen, etc.; but the main thing most of them wished to know was, whether I do really exist, or whether I am a mere myth, and you only humbugging the people with fictitious names for the purpose of deceiving them.

"And now I wish to say to the public further (if you will publish it), to save my answering so many letters, that my wife has not been compelled to take any more treatment for nearly five years, since which time her health has been constantly improving, and she weighs more than she ever has before, and has borne a fine, healthy boy, now almost four years old, who, of course, is smart, he being the seventh son.

"I impart this information to show the public that the Compound Oxygen is not merely a temporary relief, but that it will permanently cure and give new life and vitality to the whole system; and if any are still solicitous to know whether I am or not, I will say in the language of Daniel Webster, "I still live," and may be found with my law sign still out at 155 Kansas Ave., Topeka, Kansas.

"I hope what I have said may remove some doubts concerning the permanency of the cures performed by Compound Oxygen, and that afflicted ones may not delay too long in testing its efficacy."

The request that Judge Vrooman makes that we print his statement, we cheerfully comply with, and agree with his thought that what he has said should remove some doubts. What he has written to patients has undoubtedly helped many to accept the evidence so freely and abundantly given of the curative power of Compound Oxygen. There are others coming forward to divide the task with him, and a very interesting letter just at hand, giving in one report the record of results in three cases, one thousand miles apart, will serve to show how this relief is coming. The writer, Rev. Isaac Leonard, of Sperry, Iowa, says:

"I have been able to labor in my old field beyond all my expectations. Some Sabbaths have four services, and some weeks preaching every evening.

"My old friends express their surprise that I appear so young and vigorous. For this I am largely indebted to your Compound Oxygen Treatment. My nephew, James L. Leonard, of Iona, N. J., writes me that he has been able to accomplish more the past season than for four years past, all owing to the Compound Oxygen.

"My sister, Mrs. Mary S. Leonard, has gone to Lake Worth, Fla., at the urgency of her physician. She writes me that she discontinued the Compound Oxygen Treatment on arriving there, but that she became so nervous that she could not sleep, and became so miserable that she hardly knew what she was doing. She then resumed the Treatment, and in one week was quite comfortable again. I see many that need the Compound Oxygen, and am not slow in recommending it. You are at liberty to use my letter as you desire, with the hope that others may derive the same benefits that my friends and I have received from the use of the Compound Oxygen Treatment.

"P. S.—Two of my friends, whose address I inclose, have applied to me for your address; one in the State of Indiana and one in Burlington, Iowa. They want to see your Treatise. Please respond."

These letters show the widespread interest in this method of treatment for diseases, and in the vivid light they throw on the freedom of communication between different parts of the country, give emphasis to the thought of how great an institution is our United States mail.

A Treatise of nearly two hundred pages, entitled "Compound Oxygen," its mode of action and results, giving full and interesting information, is mailed free to every applicant by Drs. STARKEY & PALEN, 1529 Arch Street, Philadelphia, Pa.

## Business and Personal.

*The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.*

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

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## Notes & Queries

### HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

**References** to former articles or answers should give date of paper and page or number of question.

**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

**Special Written Information** on matters of personal rather than general interest cannot be expected without remuneration.

**Scientific American Supplements** referred to may be had at the office. Price 10 cents each.

**Books** referred to promptly supplied on receipt of price.

**Minerals** sent for examination should be distinctly marked or labeled.

(1) H. C. S. writes: To make a dynamo machine like that described in SUPPLEMENT, No. 161, larger, do you make the iron part larger in proportion and work with more layers of wire? A. Enlarge the different parts of the dynamo proportionately.

(2) H. L. B. asks how to connect wires in a battery telephone of three stations using ordinary electric call bells. A. Arrange your line so as to cut out all the telephones, leaving the bells normally in circuit. Any ordinary switch which will cut out your telephone and leave the bells in the circuit will answer your purpose.

(3) J. P. L. asks how the zincs and carbons in a bichromate battery for a small incandescent electric lamp are made. A. The zincs are generally cut from sheets of rolled zinc, but they may be made of zinc cast in moulds. The carbon plates cannot readily be made by a tyro. It is both better and cheaper to purchase them; however, if you desire to try the experiment of making your own carbon, you may select clean pieces of coke, finely pulverize them, mix with a small quantity of sirup or molasses into a thick paste, force the paste into a suitable mould, close the mould, leaving vents for the escape of moisture and gas, place the mould in a muffle or crucible, and cover it with powdered carbon. Heat it till the moisture is driven off and the sirup is carbonized, allow the mould to cool, then remove the plate from the mould, dip it in very thin sirup, dry, recarbonize, and repeat the operation until the plate is sufficiently dense for use.

(4) W. K. D. asks: Please inform me in correspondence column of SCIENTIFIC AMERICAN as follows: 1. The best method of rendering a magic lantern screen transparent, or as much so as white thin cotton fabric can be rendered? A. Coat your screen with a varnish made of Venice turpentine dissolved in a good quality of spirits of turpentine. A sizing of the best white glue with a little glycerine added renders a screen quite translucent. 2. Can I use a 1 inch diameter lens of 3½ inches focus to any advantage in a small photographic apparatus to make transparencies for magic lantern slides, about one inch wide, *i. e.*, the picture on the slide to be that width? What size stop, if any, should I need, and how far from lens should it be placed? Could I make a battery to run Guiscom's electric motor as efficiently as to buy it ready made by them? Also, please say if you know what difference in running power there is between the double induction motor and the V motor made by the Electro Dynamic Company, of Philadelphia. A. Your lens, if of good quality, may be used for photographic purposes in the manner suggested. You should employ different sized stops; a small stop will make a camera work deep and sharp but slow. You can make your own battery for running your motor. Consult SUPPLEMENT, Nos. 157, 159.—We do not know as to the relative merits of the two motors referred to.

(5) R. B. L. asks (1) how to construct a dry kiln to hold about 5,000 feet of lumber. A. The cost in a drying room for lumber depends upon the method used. If you have exhaust steam, that should be used in preference to live steam. In either case, coils of iron pipe are to be placed near the floor with an open platform above for piling the lumber in a proper sized room for the amount of lumber to a charge. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 375 and 479, for illustrations of drying apparatus. 2. The power of an average man compared with the horse power? A. The power of man at best performance is from ⅛ to ¼ horse power. Average men, one-sixth horse power. 3. What is the best means of transmitting power by pulleys from a horizontal line shaft to one running at right angles? A. A right angle belt is much in use, and gives as good results as any of the special angle couplers in the market. The right angle belt has a quarter twist passing around idlers on a vertical shaft. 4. The best way of constructing a "rumble" for smoothing chair legs and rounds by friction, as is done in a hollow drum, and how full should such drum be filled to give best results? A. A good "rumble" may be made from a large, strong cask by mounting it on a shaft with flanges to bolt to the heads with suitable door. Charge half full with material, and add sawdust or bran sufficient to accomplish the work.

(6) V. E. N.—Choke bore is a slight narrowing of the muzzle of shotguns to prevent the charge from excessive scatter. To be done well, a gun should be choked in boring. A good gunsmith should be able to make a fair job. Barrels are brazed together.

(7) W. S. C. writes: 1. We use shavings for fuel. When we fill up the furnace, sometimes there is a puff, and the smoke will come out round the doors. What is the reason of this? A. Gas is formed, which, mixed with the air, is explosive. 2. What is a suction chamber connected to a suction pipe designed for? A. To ease the motion of the water in the suction pipe and prevent hammering.

(8) G.—The ear drums you ask about sell for $3 per pair, silver mounted. For mending band saws, scarf the ends with a file to make a lap of three-eighths of an inch. Grind a piece of borax on a piece of slate or roughened earthenware, with water, to a paste. Take a piece of charcoal, grind one side flat on a stone, and hollow out a place in the middle a little larger than the width of the saw, so as to let the blowpipe flame go under the saw. Fasten the scarfed ends of the saw (after dipping in the borax) together with small binding wire, such as is used by jewelers. Then fasten the scarfed part of the blade over the recess in the charcoal with wire pins, seeing that the saw is straight. Lay a small piece of coin silver on the top at the edge of the scarf, and with the blowpipe throw the flame under the blade, heating until the silver melts, when it will flow through the scarf and appear on the under side, and your work is done.

(9) J. A. T. asks amount of pressure per square foot with the wind blowing at 20, 30, 40, 50, 60, 70, and 80 miles an hour. A. 2, 4½, 8, 12½, 18, 25, and 32½ pounds.

(10) K. G. McL. asks (1) how to temper clay that is used in making cast iron water pipe joints? A. By thoroughly working with water and fine sand. 2. How to tell tempered clay? A. By its soft, tenacious feel.

(11) F. P.—Valves should have the full area of the suction pipe, and should lift ¼ of their diameter.

(12) F. D. W.—In the vicinity of New York, tin waste is utilized by the chemical manufacturing companies, for the production of tin salts and polishing powders. The tin scrap is boiled in hydrochloric acid, or sodium hydrates, from which are reduced the salts and pigments used in the arts. Do not know of any patents on these processes.

(13) W. T. F.—The difference in pressure between the top and bottom of a boiler is due to the weight of the water, which is about 0·43 pound per inch for each foot in height of solid water. This should make no difference in choice of the place for the entrance of the feed water.

(14) P. L. asks: 1. Will an eight horse power boiler, using steam at 65 or 70 pounds per square inch, run an engine of four horse power (really a six horse engine, but speeded down to four) and heat a room 45x80 feet and room about 25x80 feet, using the exhaust while engine is running, but having pipe connections, so that live steam can be turned in when engine is shut down? The boiler is a first class upright tubular one, having heating surface equal to over eight horse power, and with inspirator. If boiler will not heat rooms and run engine, how large a boiler will it need? A. It requires one-half the power of your boiler to heat the rooms. If you use the exhaust steam for heating, adding a small jet of live steam when required, you may accomplish considerable economy in fuel. For this purpose, better consult with some steam heating engineer as to details. 2. A plumber in this town claims that there is no more heating capacity in steam at 60 than at 8 pounds per square inch. Is he right? A. He is wrong.

(15) W. T. F.—Multiplying the square of the diameter by 0·7854 gives the area of the piston; multiply the area by the pressure for the whole pressure on the piston. To get the mean engine pressure when a cut-off is used requires a special computation, which you may find in Haswell's Engineer's Pocket Book. A steam gauge will not be harmed at 2 or 3 inches from the boiler, provided there is a siphon below it to keep the steam from heating the interior of the gauge. The firm from whom you purchased the gauge will have it tested.

(16) L. J. S.—Cold cellars, as arranged in New York on the plan you state, have a uniform temperature of 33 to 34 degrees Fah. Such cellars have a pipe surface of one square foot to each 10 cubic feet of space, or 1 lineal foot of inch pipe to 3⅓ cubic feet of space. The manner of circulating is of importance. It is desirable that the individual circuit or travel of the brine should not be over 200 feet in length, and that the coils should be so arranged that every pipe shall have an equal circulation. The brine should be kept at near the point of saturation. The ice need not be crushed fine, but rather in lumps, keeping the tank full of ice, with an overflow for the waste brine. The return stream should pour on top of the ice, and the outflow from near the bottom of the tank, with an ample strainer, the salt being fed with the ice. The "tank pumps" are also preferred as a circulating power, as they move nearly twice the quantity of brine with the same size steam cylinder that the power pumps do. Rapidity of circulation is important. The circulating pipes should be covered with frost when the conditions are right. There is no better or cheaper process with chemicals, except with a refrigerating machine.

(17) W. F. B.—A locomotive built by the Baldwin Locomotive Works, for the Central Railroad of New Jersey, has made 75 miles per hour on straight track, with 5 passenger cars. There are other locomotives in England and the United States that can do as well or possibly a little better for short drives. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 231, for a description of the Baldwin locomotive.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

G. B. C.—Nothing definite can be said concerning the specimen unless it was analyzed. It appears, however, to be graphite. Its value depends upon the extent and availability of the deposit.

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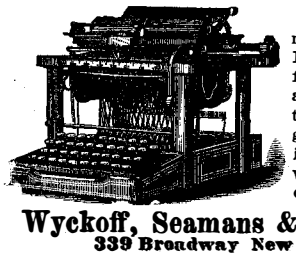

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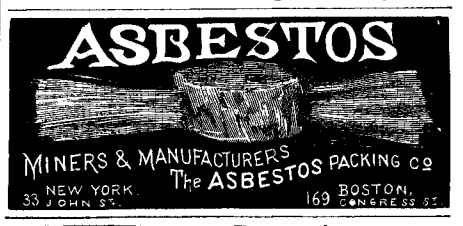

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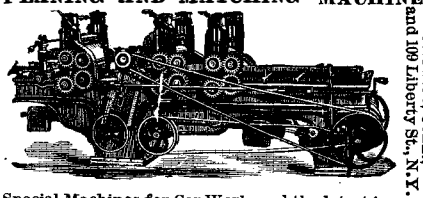

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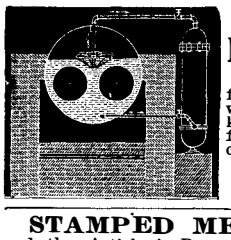

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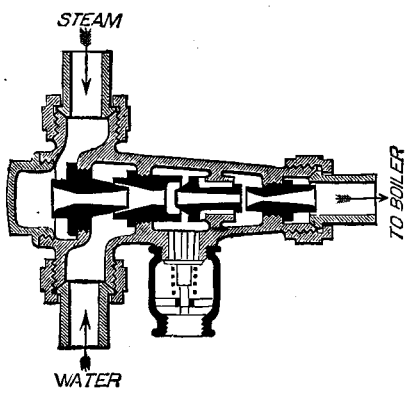


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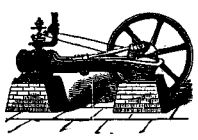

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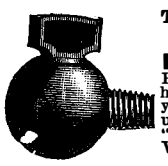

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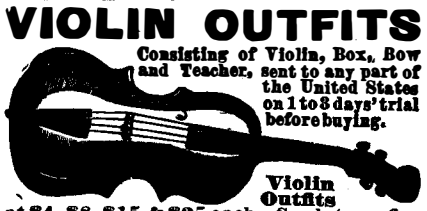

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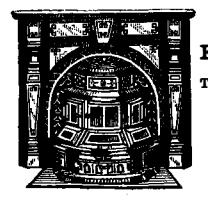

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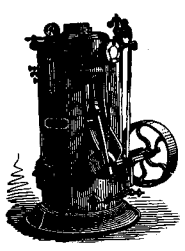

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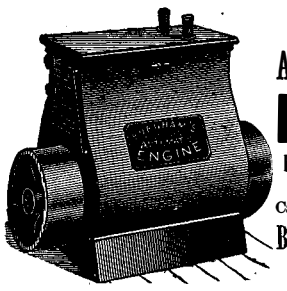

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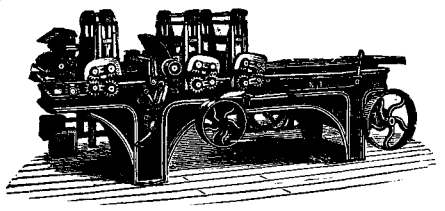

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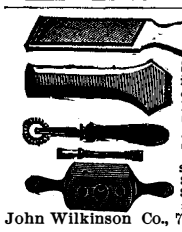

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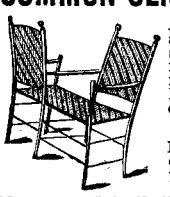

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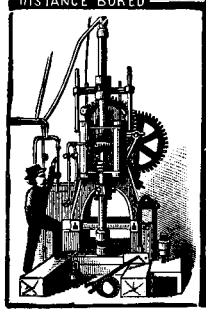

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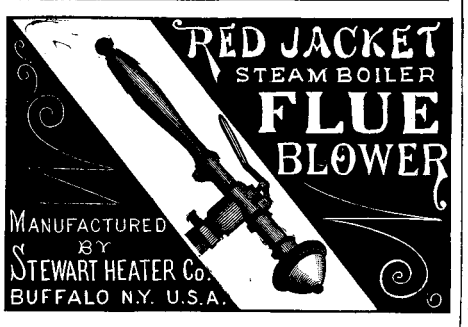


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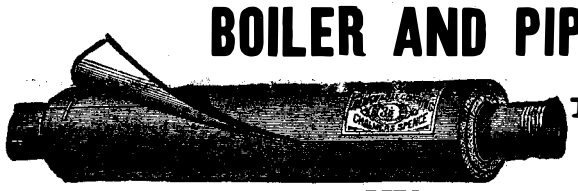

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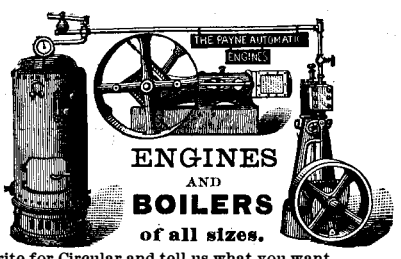


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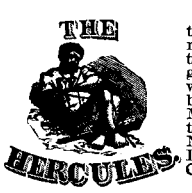


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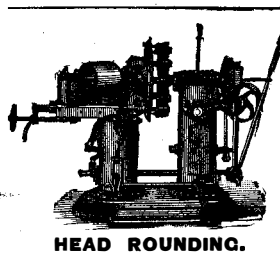

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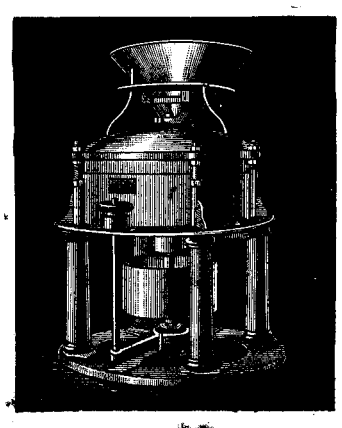

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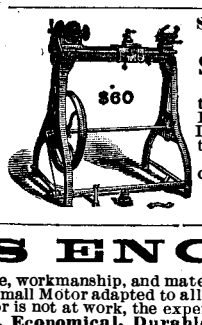


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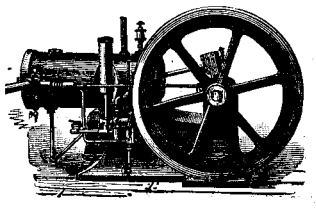

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